USER'S HANDBOOK

4101B

datron

INSTRUMENTS

MULTIMETER CALIBRATION SOFTWARE

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USER'S HANDBOOK

for

DATRON INSTRUMENTS 4101B
Multimeter Calibration Software

850088 Issue 1 (Sept 1987)

Due to our policy of continuously updating our products, this handbook may contain minor differences in specification and design to the software actually supplied. Amendment sheets precisely matched to your software set serial number are available on request.

DANGER
HIGH VOLTAGE

THIS INSTRUMENT IS CAPABLE OF DELIVERING

A LETHAL ELECTRIC SHOCK!

FRONT or REAR terminals carry the Full Output Voltage.

THIS CAN KILL!

Guard terminal is sensitive to over-voltage

It can damage your instrument!

Unless **you** are **sure** that it is **safe** to do so,
DO NOT TOUCH the **I+ I− Hi** or **Lo leads** and **terminals**

DANGER

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THE DATRON 4100 SERIES OF AUTOMATED CALIBRATION SYSTEMS

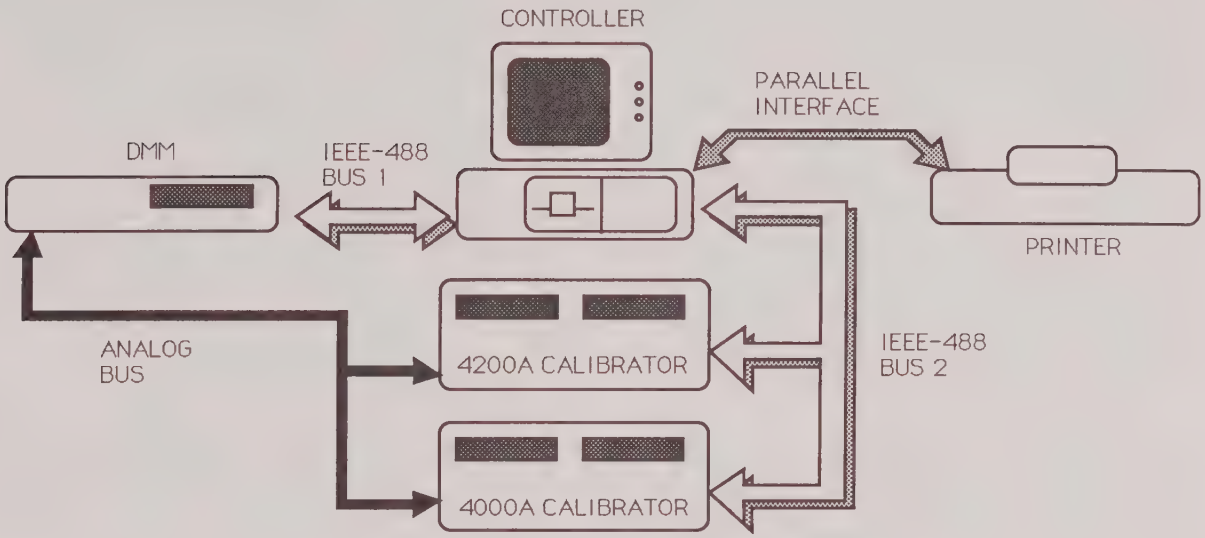


Fig 1.1. Basic system configuration. Note that the 4000A/4200A Calibrator combination may be replaced by a single 4700, 4705 or 4707 Multifunction Calibrator.

1.0 Introduction

The Datron 4100 Portocal system is a precision automatic multimeter calibration station featuring a wide range coverage of DC Voltage, DC Current, AC Voltage, AC Current and Resistance functions to exceptionally high accuracy and all under computer control.

The high accuracy of Portocal's calibrators ensures that most multimeters currently available may be calibrated by the system.

The general purpose multimeter calibration software package supplied with the system is totally menu driven and can be used to develop, store and repeatedly run calibration procedures for the majority of analog or digital multimeters, presenting the results on a color monitor display or in the form of a high quality calibration certificate.

Additionally, the software package includes an extensive instrument inventory and recall results management program, which can be used to aid historical results analysis and calibration workload planning.

1.1 Standard Configuration

Any of Datron's precision programmable calibrators can be combined with a selection of recommended IEEE-488 Instrument Controller configurations and the system printer to make up a calibration system, the basic configuration of which is shown in Fig 1.1.

1.1.1 System Calibrators

i) Datron 4000A Autocal DC Standard: The 4000A DC Standard is used to provide DC voltage, DC Current and Resistance calibration sources under the control of the system's Controller via the IEEE-488 Interface Bus. If a 4000A is being used in a Portocal system, it will normally be configured with a 4200A.

ii) Datron 4200A Autocal AC Standard: The 4200A AC Standard provides AC Voltage and AC Current calibration sources, also under the control of the system's Controller via the IEEE-488 Interface Bus. The 4200A will normally be configured with a 4000A when used in a Portocal system.

iii) Datron 4707 Autocal Multifunction Standard: The 4707 Multifunction Standard is used to provide DC voltage, AC voltage, DC Current, AC current and Resistance calibration sources under the control of the system's Controller via the IEEE-488 Interface Bus.

iv) Datron 4700 Autocal Multifunction Calibrator: The Datron 4700 Multifunction Calibrator is used to provide DC voltage, AC voltage, DC Current, AC current and Resistance calibration sources under the control of the system's Controller via the IEEE-488 Interface Bus.

v) Datron 4705 Autocal Multifunction Calibrator: The Datron 4705 Multifunction Calibrator is used to provide DC voltage, AC voltage, DC Current, AC current and Resistance calibration sources under the control of the system's Controller via the IEEE-488 Interface Bus.

1.1.2 System Controllers

Datron 4103 IBM Controller:

a) IBM-XT System Unit (includes 640K RAM, one 360K floppy disk drive, one 20M hard disk, and an Asynchronous Communications Adaptor)
b) Parallel Printer Adaptor
c) Color Card
d) Color Monitor
e) Keyboard
f) IBM PC DOS (3.0 or later)
g) IBM Advanced Basic (BASICA)
h) Ziatech ZT 1488A and zSBx 20 IEEE-488 interface cards
i) Ziatech ZT 97007 Basic Driver

Note that items (h) & (i) are available as Datron part number 440127

ii) Datron 4103A HP Vectra Controller:

a) HP Vectra PC Model 45 (HP 72445A) (includes 640K RAM, a 1.2M floppy disk drive, and keyboard)
b) 40M hard disk (HP 45817A)
c) Serial/Parallel Interface (HP 24540A)
d) Multimode Video Adaptor (HP 45981A)
e) Multimode Color Adaptor (HP 45984A)
f) 12" Color Monitor (HP 35741B)
g) HP Vectra PC DOS (HP 45951A)
h) HP Vectra PC Basic Interpreter (HP 45952A)
i) Ziatech ZT 1488A and zSBx 20 IEEE-488 interface cards
j) Ziatech ZT 97007 Basic Driver

Note that items (i) & (j) are available as Datron part number 440127

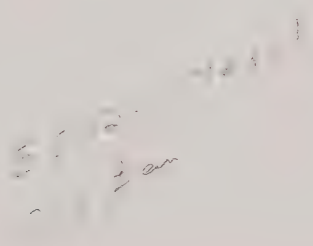
iii) Datron 4103B Compaq Portable II Controller:

a) Compaq Portable II - Model 3 (includes 640K RAM, one 360K floppy disk drive, 10M hard disk, parallel printer interface, asynchronous communications interface, keyboard, and integral monitor)
b) MS-DOS/ Basic
c) Ziatech ZT 1488A and zSBx 20 IEEE-488 interface cards
d) Ziatech ZT 97007 Basic Driver

Note that items (c) & (d) are available as Datron part number 440127

1.1.3 Datron 4104 Epson FX Series Printer

The Datron 4101B uses a parallel output port from the controller to send information to the Datron 4104 dot matrix printer. The 4101B software reprograms the character set of the printer so as to allow the printing of non-standard characters such as Ω and μ, as well as various graphics characters. Therefore, this model is the only supported printer.



1.1.4 Datron 4102 Calibration Cart

The calibrators may be mounted in the 4102 mobile calibration cart with the Controller sitting on top of the 4102 work surface. The front panel terminals of the calibrator(s) are connected in parallel to the system output connector, located just beneath the work surface. All analog outputs are provided from this single connector. A selection of special low capacitance and low leakage leads are provided to connect the system output to various types of multimeters.

The controller is connected to the calibrator(s) via the IEEE 488 interface, with the cable passing through a duct in the work surface of the cart. A printer is connected to the controller via a parallel interface.

Power to the calibrators, controller and printer comes from a distribution strip located inside the rear door of the cart.

1.1.5 PLK-1 and PLK-2 Benchtop Lead Kits

For benchtop applications where the mobility of the 4102 Calibration Cart is not required, two analog lead kits are available to connect the calibrator to the unit under test . The PLK-1 is intended for use with the combination of both the 4000A and the 4200A, paralleling up their outputs into one low-leakage lead. The PLK-2 is constructed from the same special cabling and is intended for use with solitary multifunction calibrators such as the 4707.

1.2 Safety

For protection of the user, safety trip circuits are incorporated in all calibrators to switch the OUTPUT OFF, in the event of instrument failures which might generate dangerous output voltages.

UNDER NO CIRCUMSTANCES SHOULD USERS TOUCH ANY OF THE CALIBRATOR OUTPUT, SENSE OR GUARD TERMINALS, OR THE SYSTEM OUTPUT CONNECTOR, UNLESS THEY ARE FIRST SATISFIED THAT NO DANGEROUS VOLTAGE IS PRESENT.

1.3 Optional Facilities

The capability of the 4100 system may be extended by the addition of one or more of the following options:

i) 02 Tape Back up Package: Includes Cipher 5210 Tape Back up System, connecting cable and software support. Permits rapid back up of the IBM hard disk.

ii) 03 Bar Code Reading Package: Includes HP16801A Decoder and wand and connecting cable. Portocal automatically configures itself for calibration of the correct instrument on reading the Bar Code. Recognises the following formats: 3 of 9, Interleaved 2 of 5, Industrial 2 of 5. The software to control the decoder and wand is already resident in the 4101B package.

iii) 11 Companion Desk Unit Desk Unit to stand alongside the 4102 Calibration Cart

1.4 Consumables

630130 Ribbon Cartridge for Printer
630177 Magnetic Floppy Disks
630148 Fanfold Paper for Printer
630209 DC600A Tape Cartridge for Op. 02.

1.5 Principles of Operation

1.5.1 Run / Calibrate Mode

When a procedure is run by the system, the controller programs the function, range and output settings of the calibrator over an IEEE-488 interface. The controller has an additional IEEE-488 interface which can be used to control the instrument under test, if that instrument possesses a compatible interface. The use of two IEEE-488 ports avoids address conflicts between the calibrators and the instrument under test and also aids diagnostics if there are problems with IEEE-488 communication.

If a 4000A is being used with a 4200A, turning one calibrator to the OUTPUT OFF state, will isolate its output terminals from any internal circuitry. This means it is possible to connect the terminals of both calibrators together permanently without causing any damage. The software ensures that when one calibrator has its output on, the other is off and protected from damage.

This facility means that, whatever the configuration of Portocal system, all five analog functions offered by the system can be bussed into one simple output connector, avoiding the need for a switching matrix or complex test interface panel. Analog connection to the instrument under test is accomplished through a single lead assembly.

1.5.2 Development / Review Mode

When not being used for instrument calibration, the system software offers the following facilities:

i) Developing, editing, testing, storage and printout of calibration procedures.

ii) Developing, editing, storage and printout of calibration certificate formats.

iii) Recall, viewing and printout of past results.

iv) Searching through the database of instrument details stored on the system for management analysis and planning.

v) Archiving of results for long term storage.

vi) Back up of files and programs for security purposes.

SECTION 2: HARDWARE INSTALLATION

This section contains information and instructions for unpacking and installing the Datron 4100 Portocal system.

2.1 Unpacking & Inspection

Every care is taken in the choice of packing materials to ensure that your equipment will reach you in perfect condition.

If the equipment has been subject to excessive mishandling in transit, the fact will probably be visible as external damage to shipping cartons. In the event of damage, the shipping container and cushioning material should be kept for the carrier's inspection.

Unpack the equipment and check for external damage to cases, sockets, etc. If damage is found, notify the carrier and your sales representative immediately.

2.2 Preparation

This section assumes that the system is being configured with a Datron 4102 Calibration Cart. For benchtop systems please refer to the individual calibrator's user handbooks for information on preparation for operation.

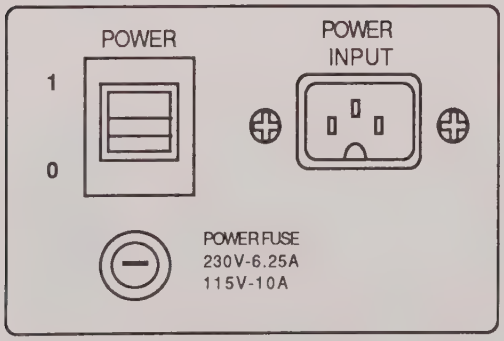


Fig. 2.1 4102 Calibration Cart Power Input.

2.2.1 System Power Input

The recessed filter power input plug, power fuse and power on/off switch are located at the rear of the right hand side of the 4102 calibration cart. (Figure 2.1).

WARNING !

THE POWER SWITCH SHOULD NOT BE SET TO ON UNTIL ALL POWER CONNECTIONS DETAILED IN THIS SECTION HAVE BEEN COMPLETED.

2.2.2 Power Cable

The detachable supply cable, consisting of 2 metres of 3 core PVC sheath cable, permanently moulded to a fully shrouded 3 pin socket, fits in the power input plug recess and should be pushed firmly home. The supply lead should be connected to a grounded outlet ensuring that the ground lead is connected. Connect black lead to live, white lead to neutral and green lead to ground.
(European: brown lead to live, blue lead to neutral and green/yellow lead to ground).
(Note: This power cable is rated to 10A).

2.2.3 Line Voltage

The 4100 is operative within the line voltage ranges 104-127 / 180-259, 50Hz or 60Hz. These ranges are factory set.

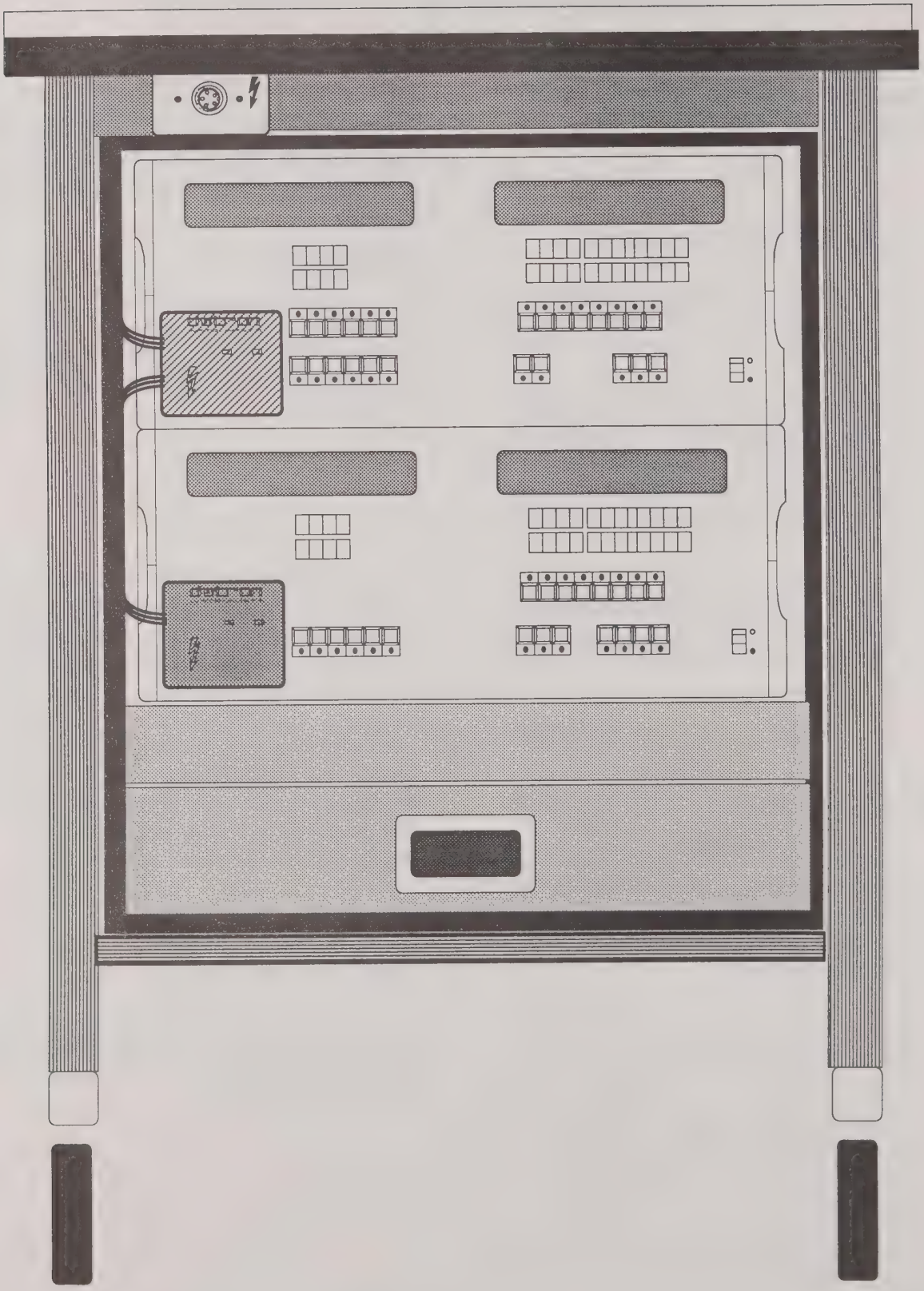


Fig 2.2 4102 Calibration Cart, with 4000A and 4200A installed.

2.2.4 Power Fuse

The fuse rating is:

10A for 104-127V line supply.
6.5A for 180-259V line supply.

It is located adjacent to the power input plug and should be of the anti-surge or slo blo type.

WARNING !

Make sure that only fuses with the required rated current and of the specified type are used for replacement.

THE USE OF MENDED FUSES AND THE SHORT-CIRCUITING OF FUSE HOLDERS SHALL BE AVOIDED AND RENDERS THE WARRANTY VOID.

2.2.5 Assembling the System

The Datron calibrators are mounted in the 4102 calibration cart as shown in Fig. 2.2. Note that the calibration cart is designed to carry the two calibrators (4000A and 4200A), with the 4200A uppermost due to the higher air circulation that is required by the 4200A.

CAUTION: Note that the Datron calibrators are designed to be supported at the front and rear. At no time should these calibrators be supported on only front brackets. Assistance is required to fit the calibrators into the 4102.

2.2.6 Digital Connections

i) Datron 4000A: Set the IEEE-488 address to 4 using the six way miniature binary coded switch near the interface connector on the rear panel. For further information, refer to page 5-4 in the 4000A Users Manual.

ii) Datron 4200A: Set the IEEE-488 address to 8 using the six way miniature binary coded switch near the interface connector on the rear panel. For further information, refer to page 5-4 in the 4200A Users Manual.

iii) Datron 4707, 4700 or 4705: Set the IEEE-488 address to 2 using the six way miniature binary coded switch near the interface connector on the rear panel. For further information, refer to page 5-4 of the relevant Users manual.

iv) IEEE cables: If the Datron 4000A and 4200A calibrators are being used, then a half-metre IEEE-488 cable can be used to link the IEEE-488 connectors (J27) of the calibrators. Use a 2m IEEE-488 cable to connect J27 of one of the Datron calibrators through the slot in the top of the 4102 work surface to the left hand IEEE-488 connector of the controller, as viewed from the rear of the computer. The right hand IEEE-488 connector of the controller can be used to connect to an instrument under test when the system is in use.

v) Printer Connection: Connect the 4104 Epson printer to the controller printer slot using the printer cable.

vi) Monitor and Keyboard Connections: If appropriate, connect the color monitor and keyboard to the controller.

2.2.7 Power Connections

Take the shrouded m/f power leads and connect the controller, monitor, printer, and Datron calibrator(s) to the power distribution strip situated inside the rear door of the 4102 cabinet.

2.2.8 Analog Connection

Inside the front door of the 4102 cabinet, the terminal connector boxes should be pushed firmly home onto the output terminals of the calibrators. (Figure 2.2).

The switches on the front of the terminal connector boxes shown in Figure 2.3 provide a convenient method for permanently linking I- to Guard (Local Guard) and Guard to Ground (if required).

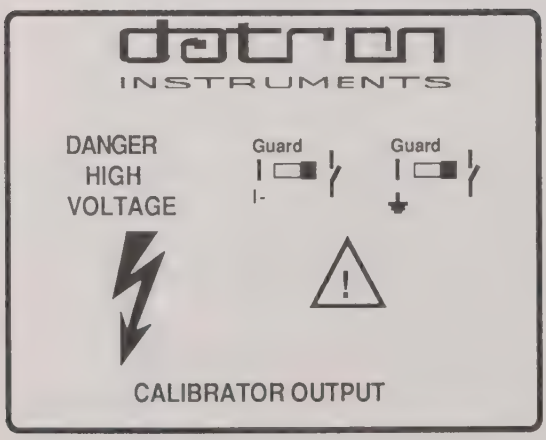


Fig 2.3 Terminal Connector Box.

The recommended setting of these switches for the Portocal system is:

(i) Guard to Ground: For the 4000A/4200A setup, closed on the 4200 and open on the 4000A. Closed for a single 4705, 4700 or 4707 calibrator.

(ii) I- to Guard: Open on all calibrator configurations.

Note that these configurations are optimal, as they will generally not require different settings to be switched during a calibration procedure. They may, however, introduce measurement problems, particularly with high frequency ACV measurements, and especially with DMMs that do not posess internal guard shields.

The terminal boxes are connected in parallel to the system output connector (Figure 2.4) which is located just beneath the left hand front edge of the 4102 work surface.

A selection of analog leads are provided with the system to connect the system output to the instrument under test and some examples are shown in Figure 2.5. These leads allow the operator to select either low thermal plugs or spades in order to connect to the instrument under test, while yet another lead terminates in a connector box, specifically designed for Datron Autocal Multimeters.

The multimeter connector box also has a switch for convenient switching of 2-Wire/4-Wire terminal connections. It should be noted that the multimeters' own switches should be set to 4-Wire Ohms so that the connector box switch can operate correctly.

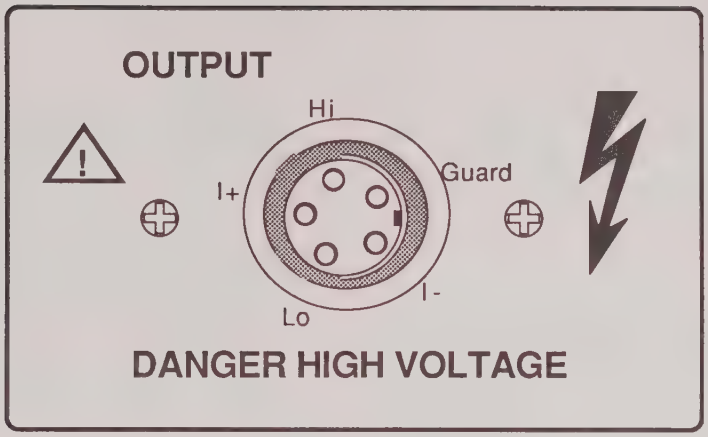


Fig 2.4 System Output Connector

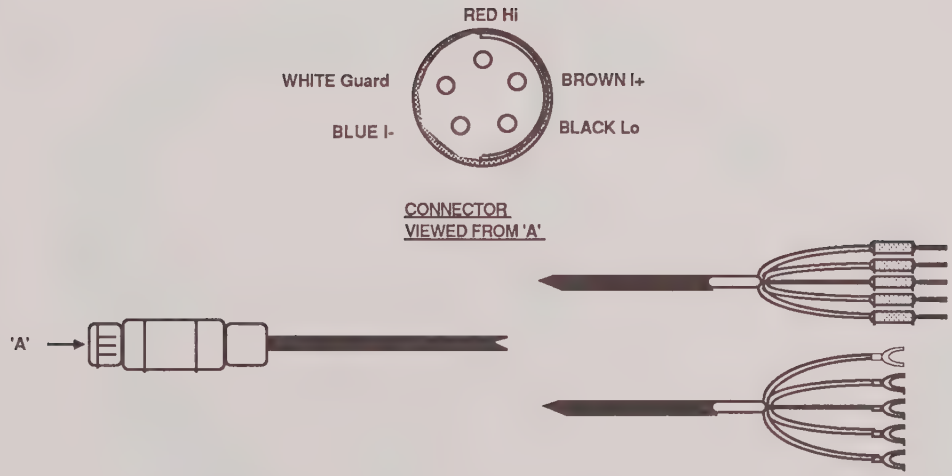


Fig 2.5 Examples of Analog Leads Available

SECTION 3: SOFTWARE INSTALLATION.

3.1 Fitting of Interface and Software Adaptor

If not previously fitted, the Ziatech IEEE-488 Interface cards and the Datron software adaptor card may be inserted into the expansion slots of the controller as follows:

i) Ensure all power to the controller is disconnected.

ii) Remove any screws and covers, exposing the internal expansion slots.

iii) The Ziatech ZT1488A, Ziatech zSBX20 and Datron Software Adaptor assembly is shown in fig. 3.1. Insert the IEEE-488 Interface card assemblies as shown in Figure 3.2.

Note that the cards may be installed in any expansion slot, and in the case of the IBM-XT and HP Vectra controllers, they should be installed so that there is an empty slot between the Ziatech assembly and the Datron Software Adaptor. In the case of the Compaq II, there are only two spare expansion slots, so they must be installed in adjacent slots.

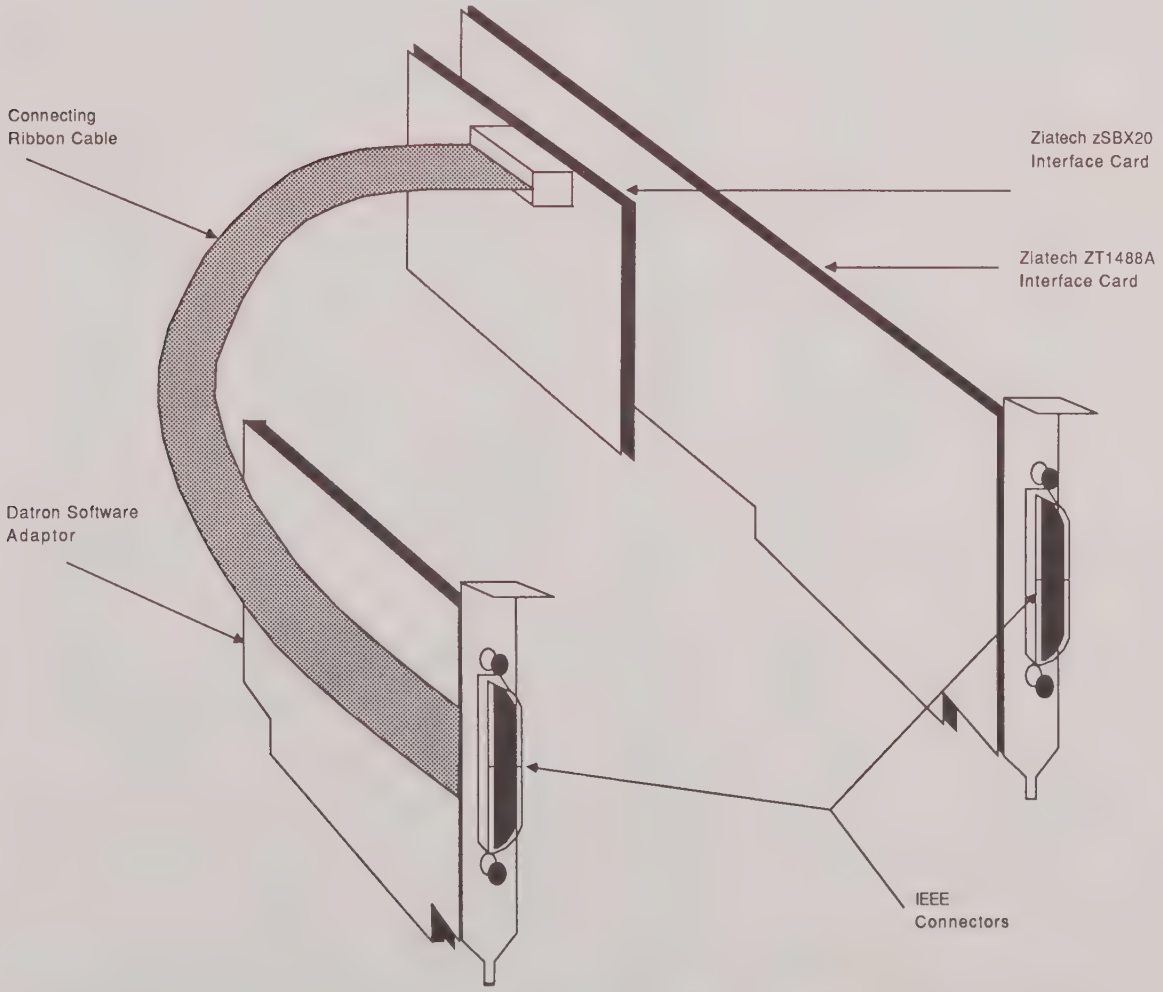


Fig 3.1 Ziatech ZT1488A, zSBX20 Interfaces and Datron Software Adaptor Assembly

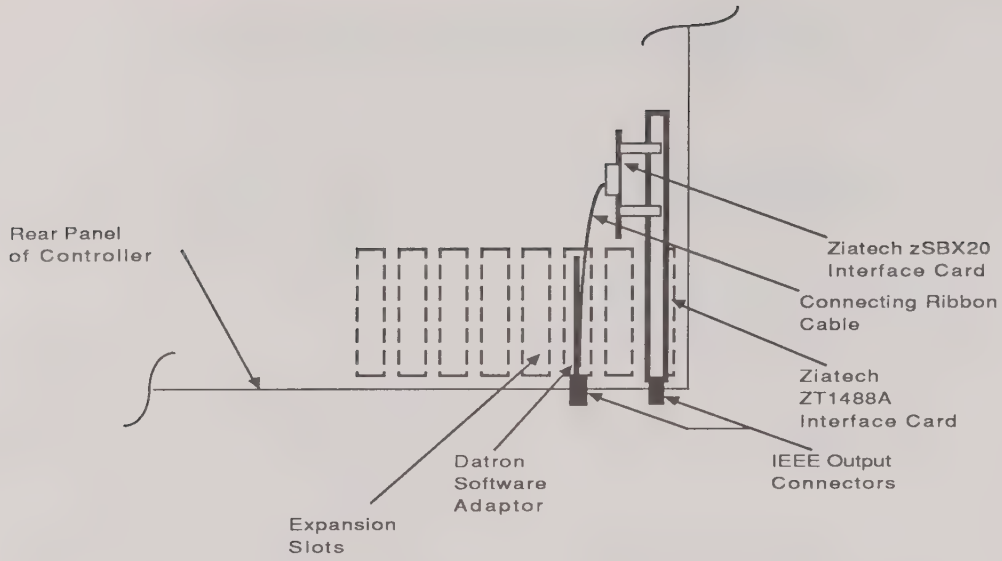


Fig 3.2 Ziatech Interfaces and Datron Sofware Adaptor as installed in an IBM-XT

FUNCTION (IBM PC)		REV 1 & A	REV B & C	DEFAULT	DATRON
GPIB I/O Address	A3	SW2-1	SW3-1	On	On
	A4	SW2-2	SW3-2	Off	Off
	A5	SW2-3	SW3-3	On	On
	A6	SW2-4	SW3-4	On	On
	A7	SW2-5	SW3-5	On	On
	A8	SW2-6	SW3-6	On	On
	A9	SW2-7	SW3-7	Off	Off
		SW2-8	SW3-8	Off	Off
Interrupt Selection	IRQ2	SW6-2	W6	Off/Out	Off/Out
	IRQ3	SW6-3	W7	Off/Out	Off/Out
	IRQ4	SW6-4	W8	Off/Out	Off/Out
	IRQ5	SW6-5	W9	Off/Out	Off/Out
	IRQ6	SW6-6	W10	Off/Out	Off/Out
	IRQ7	SW6-7	W11	Off/Out	Off/Out
	Clock Enable	SW6-8	SW2-6	Off	Off
GPIB DMA Selection	DRQ 1	SW3-1	W18	Off/Out	On/In *
	DRQ 2	SW3-2	W20	Off/Out	Off/Out
	DRO 3	SW3-3	W22	Off/Out	Off/Out
	Dack 1	SW3-4	W19	Off/Out	On/In *
	Dack 2	SW3-5	W21	Off/Out	Off/Out
	Dack 3	SW3-6	W23	Off/Out	Off/Out
	User	SW3-7	SW2-7	Off	Off
	User	SW3-8	SW2-8	Off	Off
GPIB Address	1 (LSB)	SW4-1	SW4-1	Off	On *
	2	SW4-2	SW4-2	Off	On *
	3	SW4-3	SW4-3	On	On
	4	SW4-4	SW4-4	On	On
	5 (MSB)	SW4-5	SW4-5	On	On
	User	SW4-6	SW4-6	On	On
	OC	SW4-7	SW4-7	Off	Off
	SC	SW4-8	SW4-8	Off	Off

FUNCTION (IBM PC)		REV 1 & A	REV B & C	DEFAULT	DATRON
Clock I/O Address	A5	SW5-1	SW2-1	On	On
	A6	SW5-2	SW2-2	Off	Off
	A7	SW5-3	SW2-3	On	On
	A8	SW5-4	SW2-4	On	On
	A9	SW5-5	SW2-5	Off	Off
	Unused	SW5-6,7,8			
Clock Int. Selection		SW7-1	W12	Off/Out	Off/Out
	IRQ2	SW7-2	W13	Off/Out	Off/Out
	IRQ3	SW7-3	W14	Off/Out	Off/Out
	IRQ4	SW7-4	W15	Off/Out	Off/Out
	IRQ5	SW7-5	W16	Off/Out	Off/Out
	IRQ6	SW7-6	W17	Off/Out	Off/Out
	IRQ7	SW7-7	W33	Off/Out	Off/Out
Test/Normal	Test Mode	SW7-8	W32	On/In	On/In
Multimodule I/O Address	A4	SW1-1	SW1-1	On	On
	A5	SW1-2	SW1-2	Off	Off
	A6	SW1-3	SW1-3	On	On
	A7	SW1-4	SW1-4	On	On
	A8	SW1-5	SW1-5	On	On
	A9	SW1-6	SW1-6	Off	Off
	MINTRO Disable	SW1-7	SW1-7	On	On
	MINTR1 Disable	SW1-8	SW1-8	On	On
Optional Multi- Module Addressing	A3 Select	W5	W3	In	In
	A4 Omit	W3	W5	In	In
	A5 Select	W4	W4	Out	Out
Multimodule DMA Selection	DRQ1	SW8-1	W24	Off/Out	Off/Out
	DRQ2	SW8-2	W26	Off/Out	Off/Out
	DRQ3	SW8-3	W28	Off/Out	Off/Out
	DACK1	SW8-4	W25	Off/Out	Off/Out
	DACK2	SW8-5	W27	Off/Out	Off/Out
	DACK3	SW8-6	W29	Off/Out	Off/Out
	Unused	SW-7,8			
GPIB Shield Ground		W1	W1	In	In
Backpanel Bracket Ground		W2	W2	In	In
Secondary (piggyback) Board (zSBX20)		SW1-1	SW1-1	Off	Off
		SW1-2	SW1-2	Off	Off
		SW1-3	SW1-3	Off	Off
		SW1-4	SW1-4	Off	Off
		SW1-5	SW1-5	Off	Off
		SW1-6	SW1-6	Off	Off
		SW1-7	SW1-7	Off	Off

Table 3.1 Ziatech ZT1488A and zSBX20 Switch Settings. Note that switches that require a different setting from Default are highlighted with a *.

The required settings of the jumpers and switches on the Ziatech ZT1488A and zSBX20 cards are shown in Table 3.1.

iv) Insert the software adaptor as shown and attach the ribbon cable to the IEEE-488 card assembly.

v) Replace any covers and screws.

3.2 Loading the software

The Portocal system uses the Controller's hard disk almost exclusively for program and data storage. The floppy disk drive is used either to offload or backup information held on the hard disk, or for loading programs or files onto the hard disk.
All program and data files used by the 4101B software are stored in a sub-directory called PORTOCAL, ensuring that the software will run independently of any other applications software resident on the computer.
Correct operation of the 4101B software requires that the computer's operating system is correctly installed, in which case, proceed to paragraph 3.2.2, installation of 4101B.

3.2.1. System (DOS) Initialization.

3.2.1.1 Formatting the Hard Disk.

The procedure for installation of the 4101B software requires that the hard disk has been correctly formatted.
To check that this is the case, firstly power-up the computer with no disk in the floppy disk drive, and if the disk has been correctly formatted, then the computer will respond with the prompt C> (or in the case of the HP-Vectra, the Personal Applications Manager, PAM). If this is not the case, then refer to the DOS manual supplied with your computer for the procedure required to correctly format the hard disk.
For the IBM-XT, HP-Vectra and Compaq II models, the command FORMAT C: /S/V should be used, and the procedure is detailed in the DOS user's manuals.

IBM-XT users should refer to the DOS manual, chapter 3, which is entitled "Preparing Your Fixed Disk".

HP-Vectra users should refer to the MS-DOS User's Reference, chapter 6, which is entitled "Hard Disk Preparation".

COMPAQ II users should refer to the MS-DOS Version 3 Reference Guide, chapters 1 and 6, which are entitled "Introduction" and "Diskinit" respectively.

3.2.1.2 Checking the DOS version.

If the computer is an HP-Vectra, it will first be necessary to exit PAM. Using the cursor control keys on the numeric keypad on the right-hand-side of the keyboard, move the highlighted bar until it is over the legend DOS COMMANDS, and press the return key.

At the C> prompt, type VER ↵ . The computer will respond with information regarding the DOS version installed on the hard disk.

For IBM-XT, the version returned must be 3.0 or greater.
For HP-Vectra and Compaq II, the version returned must be 3.1 or greater.
If the DOS installed is of an earlier version, it will be necessary to obtain and install a DOS of the correct version.

3.2.1.3 Installing the DOS.

The format process used will, at the same time, initialize the minimum DOS required for system operation. This minimum DOS configuration, however, is not sufficient for correct operation of the 4101B software.

To install the remainder of the DOS, place the DOS disk supplied with the system in the floppy disk drive and type

COPY A: *.* C:\↵

The DOS files required will now be installed onto the hard disk, and as each program is copied, its name will be echoed onto the screen. When the C> prompt returns, remove the disk and store in a safe place.

3.2.1.4 Note for experienced DOS users

It is not necessary to install the DOS command files into the root directory, they may be placed in any sub-directory, as long as the 4101B software is later informed of its location.

3.2.1.5 Special note for IBM-XT users

There is one additional DOS program that is required by the 4101B software, which is not supplied on the DOS diskette. It will be necessary to obtain the diskette laballed "DIAGNOSTICS", which is supplied inside the front cover of the manual labelled "GUIDE TO OPERATIONS". Place the disk in the drive and, at the C> prompt, type

COPY A: SHIPDISK.COM C:\↵

3.2.1.6 Note for experienced DOS users

Again, it is not necessary to copy this file into the root directory, it may be placed in any sub-directory, as long as a) it is copied into the same sub-directory as the rest of the DOS command files and b) the 4101B software is later informed of its location.

3.2.1.7 Special note for Tape Backup users

If the Cipher 5210 Tape Backup unit is to be installed at this time, it is necessary to install the software that controls the unit. Locate the floppy disk containing the Cipher Backup Utilities, place in the drive, close the hatch and type, at the C> prompt:

COPY A : FTFORMAT.COM C:\↵
COPY A : FTBACKUP.COM C:\↵

3.2.1.8 Note for experienced DOS users

Again, it is not necessary to copy this file into the root directory, it may be placed in any sub-directory, as long as a) it is copied into the same sub-directory as the rest of the DOS command files and b) the 4101B software is later informed of its location.

3.2.2. 4101B Loading Procedure.

WARNING:

THIS INITIALIZATION PROCEDURE WILL DESTROY ANY PREVIOUSLY RESIDENT PORTOCAL DATABASES, AND IS INTENDED ONLY FOR NEW SYSTEMS OR RELOADING FROM SCRATCH.

3.2.2.1 Starting the loading process.

Power up the computer and obtain the C> prompt. For HP-Vectra users, it will first be necessary to exit PAM. See paragraph 3.2.1.2 for details.

At the C> prompt, place Disk 1 of 6 of the 4101B software set (part number 400775-1.00) in the floppy disk drive, close the hatch and type
A: STARTUP ↵

This invokes the automatic software load procedure. On a computer that has previously held the 4101B software, a message "unable to create directory" may appear. This does not indicate an error condition, and so may be ignored.
If this message appears on a system that has NOT previously held the 4101B software, this indicates that there is already a file called PORTOCAL in the root directory, which must first be renamed or deleted. Consult the DOS manual supplied with your computer, the factory, or your local representative for further.

3.2.2.2 Stage 2

When the information on disk 1 of 6 has been transferred to the hard disk, a message prompting the insertion of disk 2 will appear. Remove disk 1, insert disk 2, close the hatch, and strike any key when ready.

3.2.2.3 Stage 3

When the information on disk 2 of 6 has been transferred to the hard disk, a message prompting the insertion of disk 3 will appear. Remove disk 2, insert disk 3, close the hatch, and strike any key when ready.

3.2.2.4 Stage 4

When the information on disk 3 of 6 has been transferred to the hard disk, a message prompting the insertion of disk 4 will appear. Remove disk 3, insert disk 4, close the hatch, and strike any key when ready.

3.2.2.5 Stage 5

When the information on disk 4 of 6 has been transferred to the hard disk, a message prompting the insertion of disk 5 will appear. Remove disk 4, insert disk 5, close the hatch, and strike any key when ready.

3.2.2.6 Stage 6

When the information on disk 5 of 6 has been transferred to the hard disk, a message prompting the insertion of disk 6 will appear. Remove disk 5, insert disk 6, close the hatch, and strike any key when ready.

3.2.2.7 Stage 7

When the information on disk 6 of 6 has been transferred to the hard disk, a message prompting the removal of disk 6 from the floppy disk drive will appear. Remove the disk, place it with the other five, and store the set of six disks in a safe place. Strike any key when ready.

3.2.2.8 Restarting the system.

A message " To use the software, the system MUST be restarted by pressing the [Ctrl] [Alt] and [Del] keys simultaneously“ will appear.

Press the [Ctrl] and [Alt] keys simultaneously, and while they are depressed, press the [Del] key. This will cause the system to restart (otherwise known as boot or reset).
If this action is not performed, the 4101B will not run correctly.

3.2.2.9 Note for experienced DOS users

The automatic loading procedure will load all of the program and data files required by the 4101B software from the set of six floppy disk required into a directory called PORTOCAL, thus leaving any other software on the hard disk unaltered. The one exception is the file CONFIG.SYS, resident in the root directory. The original copy of CONFIG.SYS is copied to CONFIG.OLD and two statements:

BUFFERS=20
FILES=20

are appended to the end of the original copy of CONFIG.SYS. It is imperative that the system is restarted using either the CONFIG.SYS that has been created by the loading process, or a CONFIG.SYS that contains these two statements, as the default DOS settings do not allow the correct operation of the 4101B software.

3.2.3 Initializing the installed 4101B software.

Before the newly-installed 4101B software may be used for multi-meter calibration, it must informed of a number of parameters. This initialization process is accomplished by providing responses to s series of prompts offered by the software.

3.2.3.1 Invoking the 4101B software.

At the C> prompt (HP-Vectra users should refer to paragraph 3.2.1.2 for details on how to exit PAM) and type

CD \ PORTOCAL ↵
PORTOCAL ↵

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The correct initialization of the 4101B software will later cure this problem. However, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.

The Portocal Entry Page, shown in fig. 3.3, will appear on the screen.
Press the spacebar to continue, and the Portocal Title Page, shown in fig. 3.4, will appear. Press the spacebar again, and the Manager - System Configuration menu will appear (fig 3.5). These three pages will be displayed in monochrome, even if a color monitor is installed. Once the 4101B software has been correctly installed, then, if required, the color capabilities of the computer may be utilized.

The information entered in this page informs the 4101B software how to communicate with the DOS, the Calibrator(s) and the user. Note that the fields Serial Number and the Issue are not available to the user, and the information contained therein is fixed.

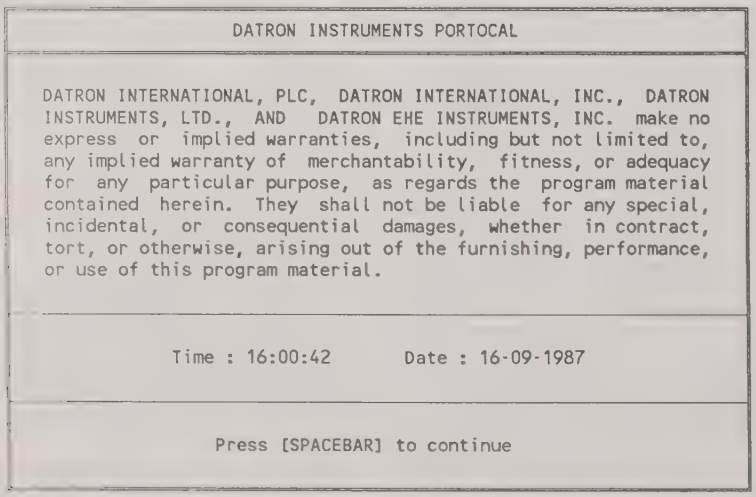

DATRON INSTRUMENTS PORTOCAL
DATRON INTERNATIONAL, PLC, DATRON INTERNATIONAL, INC., DATRON INSTRUMENTS, LTD., AND DATRON EHE INSTRUMENTS, INC. make no express or implied warranties, including but not limited to, any implied warranty of merchantability, fitness, or adequacy for any particular purpose, as regards the program material contained herein. They shall not be liable for any special, incidental, or consequential damages, whether in contract, tort, or otherwise, arising out of the furnishing, performance, or use of this program material.
Time : 16:00:42
Date : 16-09-1987
Press [SPACEBAR] to continue

Fig 3.3 Portocal Entry Page

Fig 3.4 Portocal Title Page

3.2.3.2 Use of the function keys

The select box in the bottom right hand corner of the screen contains a choice of function keys that correspond to a choice of particular actions. As the highlighted cursor is moved from field to field, the choices presented by the select box will change accordingly.

The ↵ key will move the highlighted cursor from one field to the next, while the F8 function key will move the cursor from one block to the next. The function keys F9 (Cal config) and F10 (Syst hist) should NOT be pressed until the data entered in this page is correct.

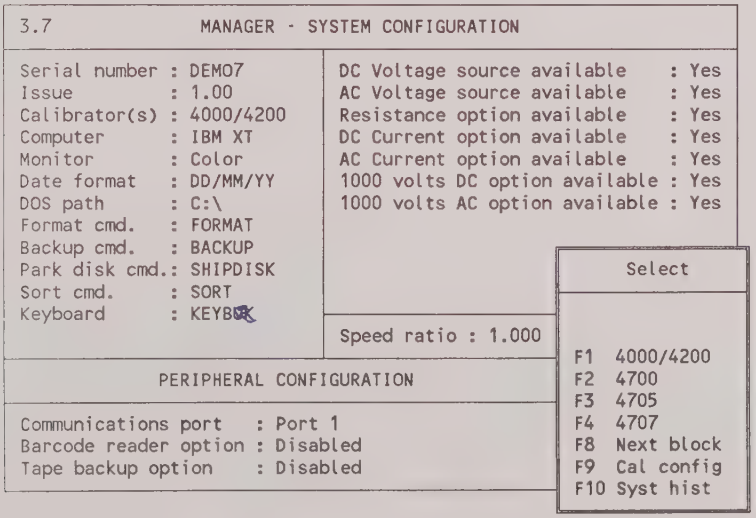

3.7 MANAGER - SYSTEM CONFIGURATION
Serial number : DEMO7
Issue : 1.00
Calibrator(s) : 4000/4200
Computer : IBM XT
Monitor : Color
Date format : DD/MM/YY
DOS path : C:\
Format cmd. : FORMAT
Backup cmd. : BACKUP
Park disk cmd.: SHIPDISK
Sort cmd. : SORT
Keyboard : KEYB
DC Voltage source available : Yes
AC Voltage source available : Yes
Resistance option available : Yes
DC Current option available : Yes
AC Current option available : Yes
1000 volts DC option available : Yes
1000 volts AC option available : Yes
Speed ratio : 1.000
PERIPHERAL CONFIGURATION
Communications port : Port 1
Barcode reader option : Disabled
Tape backup option : Disabled
Select
F1 4000/4200
F2 4700
F3 4705
F4 4707
F8 Next block
F9 Cal config
F10 Syst hist

Fig 3.5 Manager - System Configuration Menu

3.2.3.3 Calibrator(s)

Depress the function key that corresponds to the type of calibrator(s) to be used in the calibration system. If either a 4000A (DC Standard) or 4200A (AC Standard) is to be used alone, at this point, select the 4000/4200 combination. When the calibrator(s) field is correct, press the ↵ key to proceed to the Computer field.

3.2.3.4 Computer

There are three available choices in the select box; F1 (IBM), F2 (HP Vectra) and F3 (Compaq II). It is not possible to enter any other type of computer, not because others are not allowed (although others are not supported by Datron), but as this field affects the way in which the 4101B software displays the different pages of the software. If the computer is not one of the supported models, then select the IBM choice (F1). If, at a later date, the different pages of the 4101B software are presented in an untidy manner, return to this page and select the HP Vectra or Compaq II choices. When the data in this field is correct, press the ↵ key to proceed to the Monitor field.

3.2.3.5 Monitor

There are two available choices, Color (F1) and Mono (F2). Select F2 for a computer posessing a monochrome display, otherwise select F1. When this information is correct, press the ↵ key to proceed to the Date format field.

3.2.3.6 Date format

The two available formats for the display of the date are European format (F1) and American format (F2). When this information is correct, press the ↵ key to proceed to the DOS path field.

3.2.3.7 DOS path

There are no function key choices available for entering data into this field. The data entered in this field will inform the 4101B software where the DOS files that are required for various functions have been installed. If the procedure in paragraph 3.2.1.3 was followed, the data to be entered is C:\ If a mistake is made, subsequent use of the back-space key will cause the character to the left of the current cursor to be erased. When the data in this field is correct, press the ↵ key to proceed to the next field.

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The correct initialization of the 4101B software will later cure this problem, however, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.

3.2.3.8 Note for experienced DOS users

The DOS path field informs the 4101B software in which directory the DOS command files for various utilities may be found. At this point, type the directory in which the DOS command files may be found, eg C:\DOS\ Note that multiple paths (eg C:\; C:\DOS) will cause incorrect operation of the 4101B software.

3.2.3.9 Format cmd.

The data in this field informs the 4101B software the name of the DOS utility used to format a floppy disk. For IBM, HP Vectra and Compaq II, this command is FORMAT. When this is entered correctly, press the ↵ key to proceed to the Backup cmd. field.

3.2.3.10 Backup cmd.

The data in this field informs the 4101B software the name of the DOS utility used to perform a backup onto floppy disk. For IBM, HP Vectra and Compaq II, this command is BACKUP. When this data is entered correctly, press the ↵ key to proceed to the Park disk cmd. field.

3.2.3.11 Park disk cmd.

The data in this field informs the 4101B software the name of the DOS utility used to park the disk prior to relocation of the computer system.

For IBM, enter SHIPDISK

For HP Vectra, this is SETUP

For Compaq II, this should be left blank as a self-parking disk is standard equipment with this model.

When this data is entered correctly, press the ↵ key to proceed to the Sort cmd. field.

3.2.3.12 Sort cmd.

The data in this field informs the 4101B software the name of the DOS utility used to perform an alphabetical sort of the data in a file. For IBM, HP Vectra and Compaq II this is SORT. When the data is entered correctly, press the ↵ key to proceed to the Keyboard field.

3.2.3.13 Keyboard.

The data in this field informs the 4101B software the name of the keyboard driver file for the computer used. The possibilities are:

KEYBFR for a French system
KEYBGR for a German system
KEYBIT for an Italian system
KEYBSP for a Spanish system
KEYBUK for a British system
For a US system, this field should be left blank.

Choose the correct keyboard driver file for your system, using the appropriate function key as detailed in the select box, and when the data in this field is entered correctly, press the ↵ key to proceed to the Sources Available block.

Calibrator	Options	Source options available.
4000A	–	DCV, 1kVDC
4000A	20	DCV, 1kVDC, Ω, DCI
4200A	–	ACV
4200A	10	ACV, 1kVAC
4200A	30	ACV, ACI
4200A	10,30	ACV, 1kVAC, ACI
4707	–	DCV, ACV
4707	17	DCV, ACV, 1kVDC, 1kVAC
4707	27	DCV, ACV, Ω, DCI, ACI
4707	17,27	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI
4700	–	DCV, ACV
4700	10	DCV, ACV, 1kVDC, 1kVAC
4700	20	DCV, ACV, Ω, DCI, ACI
4700	10,20	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI
4705	N/A	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI

Table 3.2 Sources Available

3.2.3.15 Sources available.

The data in these fields informs the 4101B software the configuration of the calibrators that will be connected to the computer. Press either F1 (Yes) or F2 (No) for each option and press the ↵ key when the option is correct. A table cross-referencing the calibrator hardware options and the appropriate entries is shown in Table 3.2.

3.2.3.16 Speed ratio

This field is used to inform the 4101B software of the relative speed of the controller with respect to a standard IBM XT. This is necessary as the Ziatech interface derives its handshake timing from a number of controller-dependent factors. The possibilities are:

F1 (1.000) for an IBM XT
F2 (3.049) for an HP Vectra
F3 (3.036) for a Compaq II
F4 (Test) for the automatic determination of the speed ratio.

To perform the test, first connect a Datron Instruments calibrator to the secondary IEEE port (the calibrator port), and press F4. The message "Speed ratio test in progress" will appear momentarily on the bottom line of the display, and then the number in the highlighted cursor will be modified as applicable. When the data in the field is correct, or a test has been successfully completed, press the ↵ key to continue to the Communication port field.

3.2.3.17 Communications port

This field allows the user to set up the RS-232 port for communications to a remote host or peripheral. If the RS-232 port is not to be used, press the ↵ key to proceed to the Barcode reader option field (paragraph 3.2.3.18).

3.2.1.17.1 Introduction

If the RS-232 communications facilities are to be used, an understanding of the communications capabilities is required before the port setups may be entered.

i) Calibration Procedures and Certificate Formats may be transferred between two controllers that are both running the 4101B software. Procedures and Certificate Formats may not be transferred to a peripheral or a controller that is not running the 4101B software due to the specialized file structures used.
ii) Calibration Results may be sent from a controller running the 4101B software to any remote host or peripheral, as this data is transferred in ASCII format.
iii) The 4101B software is capable of interfacing to a HP 16801A barcode reader, which also uses the RS-232 interface.

When transferring Procedures or Certificate formats, the 4101B software forces the RS-232 setups that are required, so any changes made in the setup page are over-ridden, and re-established when the operation is complete. The setups entered in this page are only active when the 4101B software is sending Calibration Results to a remote host or peripheral.

The cabling required to communicate between two Portocal Systems, and the cabling required to interface the Barcode reader to the Portocal system is detailed in Appendix I.

If it is planned to communicate calibration results to a remote controller or peripheral, these connections may not be valid. In this case, it will be necessary to obtain the RS-232 port pinouts for that equipment.

The barcode reader, which posesses a RS-232 interface, MUST be connected to communications port 1. If the controller posesses twin RS-232 ports, then it is advised that port 2 is used for communications, to eliminate the requirement to change connections. If the computer posesses only one RS-232 port, then it will typically be configured as port 1.

3.2.3.17.2 Enter Communications port setup.

If the RS232 setup is to be examined or modified, then press F3 to enter the Communications Port Setup menu (fig. 3.6). At any point in the page, the depression of the F9 key will cause the setups for that particular port to be reset to defaults values, and the depression of F10 will cause the displayed setups to be saved and the Manager - System Configuration page to return to the screen.

3.2.3.17.3 Comms port 1

This field informs the 4101B software which of the RS-232 ports to use for communications. If there is only one RS-232 connector available on the back of the computer, then port 1 should be enabled (and thus port 2 disabled). If there are two RS-232 ports available, then the user must choose which one will be used for communications.

Press F1 to set the port as active, F2 to set inactive. When the data in this field is entered correctly, press the ↵ key to proceed to the Baud rate field.

3.2.3.17.4 Baud rate

This field informs the 4101B software which baud rate will be used for communication of calibration results to a remote host or peripheral. The possibilities are:

F1 75 baud
F2 110 baud
F3 150 baud
F4 300 baud
F5 1200 baud
F6 2400 baud
F7 4800 baud
F8 9600 baud

When the data entered in this field is correct, press the ↵ key to proceed to the Data bits field.

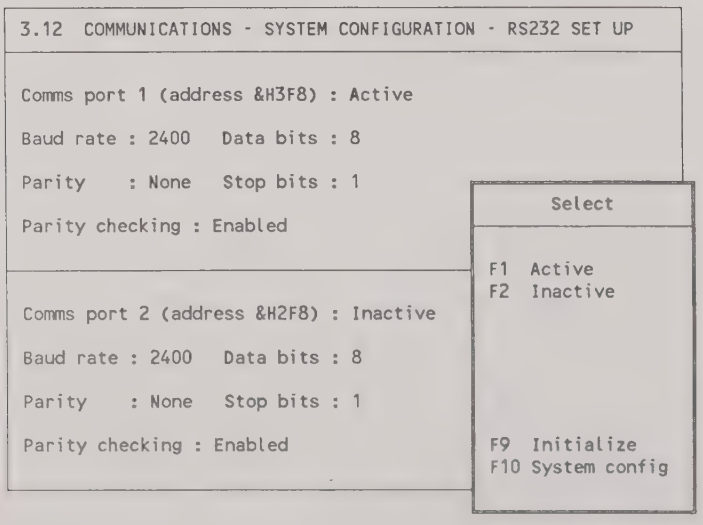

3.12 COMMUNICATIONS - SYSTEM CONFIGURATION - RS232 SET UP
Comms port 1 (address &H3F8) : Active
Baud rate : 2400 Data bits : 8
Parity : None Stop bits : 1
Parity checking : Enabled
Comms port 2 (address &H2F8) : Inactive
Baud rate : 2400 Data bits : 8
Parity : None Stop bits : 1
Parity checking : Enabled
Select
F1 Active
F2 Inactive
F9 Initialize
F10 System config

Fig 3.6 Communications Port Setup Menu

3.2.3.17.5 Data bits

This field informs the 4101B software on how many data bits are to be used to make up a data word when communicating calibration results to a remote host or peripheral. The possibilities are:

F1 5 bits
F2 6 bits
F3 7 bits
F4 8 bits

When the data in this field is correct, press the ↵ key to proceed to the Parity field.

3.2.3.17.6 Parity

This field informs the 4101B software on whether parity generation and checking is to be active when communicating calibration results to a remote host or peripheral, and if so, whether to generate and check odd or even parity. Press F1 to specify odd parity, F2 for even, or F3 for none. Note that this field cannot be entered if the number of data bits specified is 8, as the possibility of 8 data bits and parity is invalid.
When the data in this field is correct, press the ↵ key to proceed to the Stop bits field.

3.2.3.17.7 Stop bits

This field informs the 4101B software on how many stop bits are to be generated and recognized. Press F1 to select 1 stop bit, F2 to select 2 stop bits. Note that if the number of data bits selected is 5, then the selection of 2 stop bits will actually select 1.5 stop bits. When the data entered in this field is correct, press the ↵ key to proceed to the Parity checking field.

3.2.3.17.8 Parity checking

This field informs the 4101B software on whether or not parity checking is to be enabled or disabled. Press F1 to disable parity checking, press F2 to enable.
When the data entered in this field is correct, press the ↵ key to proceed to the setup of port 2, or press F10 to return to the Manager - System Configuration menu (Fig 3.5).

3.2.3.17.9 Communications Port 2

The settings for port 2 have exactly the same significance as the corresponding settings for port 1.

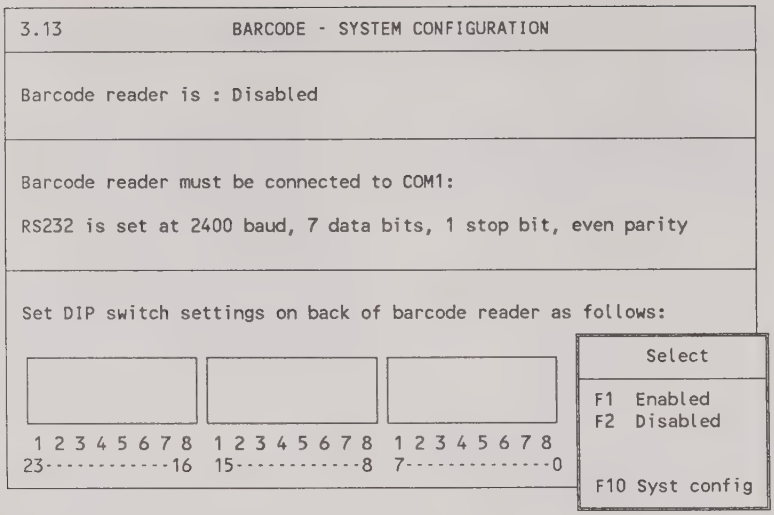

3.13 BARCODE - SYSTEM CONFIGURATION
Barcode reader is : Disabled
Barcode reader must be connected to COM1:
RS232 is set at 2400 baud, 7 data bits, 1 stop bit, even parity
Set DIP switch settings on back of barcode reader as follows:
1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8
23----------16 15----------8 7----------0
Select
F1 Enabled
F2 Disabled
F10 Syst config

Fig 3.7 Barcode Reader Setup Menu

3.2.3.18 Barcode reader option

This field informs the 4101B software if the barcode reader option is to be enabled whenever the software is prompting the operator for an instrument's serial number or code number. Select F1 to enable, F2 to disable, ↵ to proceed to the Tape backup option field, or F3 to enter the Barcode Reader setup menu (fig 3.7).

3.2.3.19 Tape backup option

This field informs the 4101B software if the tape backup option is to be available for the backup of the hard disk. Select F1 to enable, F2 to disable, ↵ to proceed to the Calibrator(s) field, or F3 to enter the setup page (fig. 3.8)

/

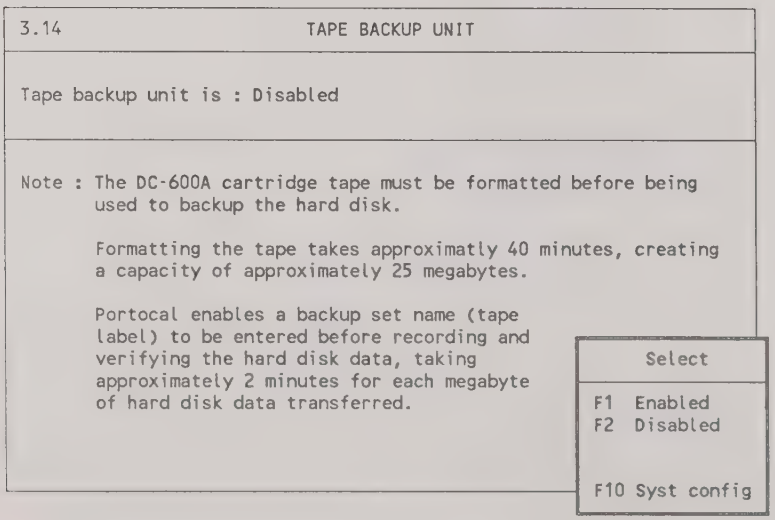

3.14 TAPE BACKUP UNIT
Tape backup unit is : Disabled
Note : The DC-600A cartridge tape must be formatted before being used to backup the hard disk.
Formatting the tape takes approximatly 40 minutes, creating a capacity of approximately 25 megabytes.
Portocal enables a backup set name (tape label) to be entered before recording and verifying the hard disk data, taking approximately 2 minutes for each megabyte of hard disk data transferred.
Select
F1 Enabled
F2 Disabled
F10 Syst config

Fig 3.8 Tape Backup Unit Setup Menu

3.2.4 Installation of the Calibrator(s)

If it is required to install calibrator(s) or to check or modify the time and date stored on the Ziatech interface, then select F9 (Cal config) from the Manager - System Configuration page (Fig 3.5). The system will respond with a message "Please wait - Initialising certificates" while the 4101B software configures itself for the use of the specified calibrator(s).

3.2.4.1 If no Calibrators are connected

If there is no calibrator connected to the secondary IEEE port, the Calibrator Configuration menu, fig. 3.9 will appear and a message "No calibrator Select F1-Ignor F2-Retry ESC-Abort" will be displayed on the bottom line of the screen. The selection of the F1 key to ignore allows the user to enter the calibrator configuration page, but access is only allowed to the Date and Time fields.
To modify the date, with the highlighted cursor over the date field, type in the correct date in the format that was specified in the Manager - System Configuration page (see paragraph 3.2.3.6). Note that it is not possible to enter an invalid date. When the date is entered correctly, press the ↵ key to proceed to the time field.

To modify the time, with the highlighted cursor over the time field, type in the correct time. When the time entered is correct, press the ↵ key to return to the date field or select the F10 key to return to the Manager - System History menu, Fig 3.12, and proceed to paragraph 3.2.4.3

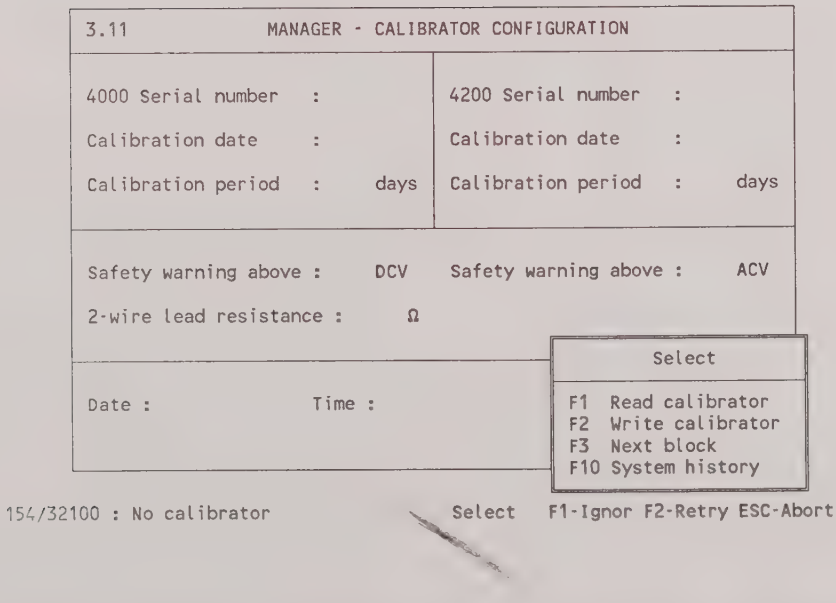


Fig 3.9 Calibrator Configuration Menu, with no Calibrator(s) connected

3.2.4.2 If Calibrators are connected, and require installation.

On entering the Calibrator Configuration menu, fig. 3.10, the 4101B software reads the serial number(s) from the calibrator(s) and compares this data to the data that is stored in the 4101B database. With a newly-installed database, there is no serial number information stored, and so the message "WARNING! XXXX Unrecognised" will be displayed, where XXXX is the type of calibrator specified in the Manager - System configuration page (see paragraph 3.2.3.3.)

If there is a failure in communications with the calibrator(s), one of the following messages will appear:

a) If the message "151/25092 IEEE Timeout" is displayed, this indicates that the 4101B has detected an instrument in the secondary IEEE-488 port (the calibrator port), but it is not responding in the time interval that the Datron calibrators are designed to do. In this case, it may be that the system Speed Ratio (refer to paragraph 3.2.3.16) has not been set or tested correctly. If this problem persists, it is generally indicative of a faulty calibrator, and it will be necessary to contact either the factory or your local representative for further assistance.

e) If the message "XXXX not at address X" is displayed, this indicates that the 4101B has found that either the address(es) of the calibrator(s) is/are incorrectly set, or that the instrument that has been located at the specified address is not responding as expected. Firstly, to check the IEEE-488 address setting of a Datron calibrator, select the 'Error' key on the front panel of the calibrator, followed by the 'Guard' key, and the address setting will be displayed on the instrument's front panel display. (Note that it will first be necessary to place the calibrator(s) under local control by turning off and back on).

4000A: should be at address 4
4200A: should be at address 8
4707: should be at address 2
4700: should be at address 2
4705: should be at address 2

If the displayed address setting, and the IEEE-488 connections are correct, this will generally be indicative of a faulty calibrator, and it will be necessary to contact the factory or your local representative for further assistance.

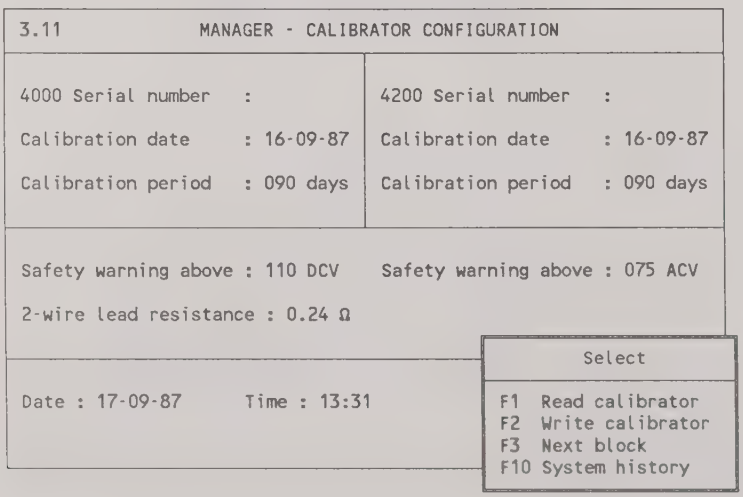

3.11 MANAGER - CALIBRATOR CONFIGURATION
4000 Serial number :
Calibration date : 16-09-87
Calibration period : 090 days
4200 Serial number :
Calibration date : 16-09-87
Calibration period : 090 days
Safety warning above : 110 DCV
Safety warning above : 075 ACV
2-wire lead resistance : 0.24 Ω
Date : 17-09-87
Time : 13:31
Select
F1 Read calibrator
F2 Write calibrator
F3 Next block
F10 System history

Fig 3.10 Calibrator Configuration Menu, with Calibrator(s) connected

3.2.4.2.1 Serial number

With the highlighted cursor over the Serial number field, type the Serial number of the calibrator, and press the ↵ key when correct. The highlighted cursor will proceed to the Calibration date field.

3.2.4.2.2 Calibration date

Enter the date when the calibrator was last calibrated, in the same format as specified in the Manager - System configuration page (see paragraph 3.2.3.6.). Press the ↵ key when when the entered date is correct, and proceed to the calibration period field.

3.2.4.2.3 Calibration period

Enter the calibration period to which the calibration system is to work to and press the ↵ key when the entered period is correct.

3.2.4.2.4 Multiple calibrators.

If the calibrators specified in the Manager - System configuration page (paragraph 3.2.3.3.) are the 4000A/4200A combination, then the serial number, calibration date and calibration period must also be entered into the correct field for the 4200.

3.2.4.2.5 Safety warning levels

The Safety warning above field allows the user to specify that audible and visual warnings are to be presented to an operator whenever the outputs from the calibrator(s) reach a dangerous level. The left hand warning level is that for DC voltages, the right hand for AC. The preset limits of 110V DC and 75V AC may be reduced at this point, but may not be increased.

Enter the safety levels above which warnings are to be presented to the operator. Press the ↵ key when the levels are set correctly.

3.2.4.2.6 2-wire lead resistance

When calibrating an instrument-under-test which has only a 2-wire resistance measurement capability, it is necessary to add the resistance of the leads to the value of the applied resistance to achieve the value of the resistance applied at the input terminals of the instrument-under-test.

To measure this resistance, perform the following measurements with a high accuracy DMM such as a Datron Instruments 1081 Autocal DMM.

Step 1: Calibrator setting:
Resistance function, 1Ω (4000A) or 10Ω (47XX) range, 0Ω output setting, remote sense, output on.

DMM setting:
Resistance function, lowest resistance range (10Ω for the 1081), 4-wire measurement.

Connections:
4-wire configuration from the calibrator to the DMM. Perform an input zero on the DMM.

Step 2: Calibrator setting:
Turn the output off, select local sense and turn the output on.

DMM setting:
Change to 2-wire measurement function.

Connections:
Remove the I+ and I- leads from the DMM input terminals. Note that when using a Datron Autocal DMM, such as the model 1081/2, 1071/2, 1061/2 or 1065, failure to remove the I+ and I- leads will result in an incorrect reading.

Note the reading on the front panel of the DMM, and subtract the internal 2-wire lead resistance as displayed on the front panel of the calibrator. Enter this value into the 2-wire lead resistance field and press the ↵ key when correct.

3.2.4.2.7 Date

To modify the date, with the highlighted cursor over the date field, type in the correct date in the format that was specified in the Manager - System Configuration page (see paragraph 3.2.3.6). Note that it is not possible to enter an invalid date. When the date is entered correctly, press the ↵ key to proceed to the time field.

3.2.4.2.8 Time

To modify the time, with the highlighted cursor over the time field, type in the correct time. When the time entered is correct, press the ↵ key to proceed to the serial number field.

3.2.4.2.9 Write to the calibrator(s)

When a calibration procedure is initiated by the operator, the 4101B software will read the calibrator serial number, calibration date and calibration period from the calibrator(s). These must match the data that is stored on the database, therefore it is necessary to enter this information into the calibrator(s).

3.2.4.2.10 Set to calibration mode.

With the highlighted cursor over the Serial number, Calibration date or Calibration period fields, press the F2 key to initiate the write action. The message "Set calibration key to ENABLE on 4XXX Select F1-Cont ESC-Abort" will appear on the bottom line of the screen, as in fig 3.11
Insert a calibration key in the keyswitch on the rear panel of the calibrator and press F1 when set to Cal. The message "Writing to calibrator" will appear for a short time, and then the prompt "Set calibration key to RUN on 4XXX Select F1-Cont" requests that the calibrator be set back to run mode.

3.2.4.2.11 Reading resistance values.

The message "Reading resistance values" will appear if the calibrator concerned is a 4000A, 4707, 4700 or 4705. These are the calibrated resistance values that will be applied whenever a resistance is called up during a calibration procedure, and will be stored on the database.

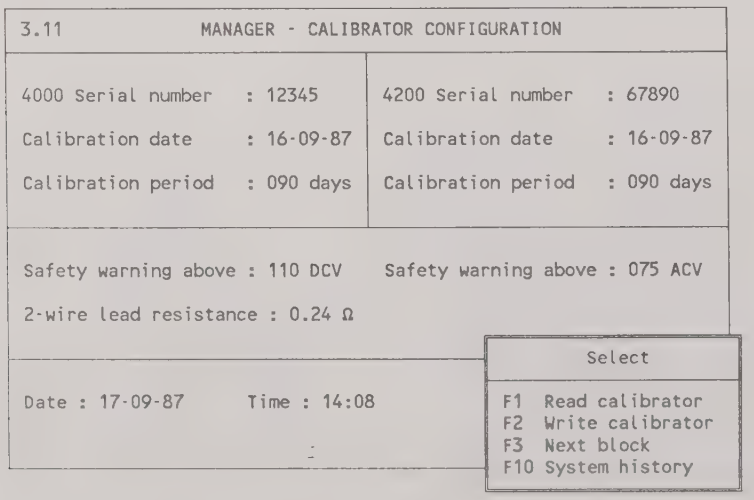

3.11 MANAGER - CALIBRATOR CONFIGURATION
4000 Serial number : 12345
Calibration date : 16-09-87
Calibration period : 090 days
4200 Serial number : 67890
Calibration date : 16-09-87
Calibration period : 090 days
Safety warning above : 110 DCV
Safety warning above : 075 ACV
2-wire lead resistance : 0.24 Ω
Date : 17-09-87
Time : 14:08
Select
F1 Read calibrator
F2 Write calibrator
F3 Next block
F10 System history

Fig 3.11 Calibrator Configuration Menu, "Set Cal Key to ENABLE"

3.2.4.2.12 Repeating for 4200A

If the calibrator configuration is a 4000A/4200A pair, then this process must be repeated for the 4200. This is accomplished by moving the high-lighted cursor, using the ↵ key or the F3 key (next block) until it is over the 4200 serial number, calibration date or calibration period fields. Press the F2 key to initiate the write to calibrator sequence (paragraph 3.2.4.2.10)

3.2.4.3 System History

Press the F10 key to proceed to the System History menu, fig 3.12. The System History menu allows the System Manager to insert text and comments into a System History file, which may be added to, saved onto disk and printed out at any time. In addition, the act of installing the software, calibrators and modifying the time and date in the above mentioned fashion automatically places an entry to that effect into the System History file. Note that data previously entered into the System History file may no be modified in any way.

Inside the System History menu, there are several function key choices that perform actions upon the System History file, and several that assist with the editing of a block of text prior to appending to the existing contents of the file.

F1 Clear Entry does not modify the contents of the History file, it merely clears the text field displayed on the screen.

F5 Insert Line does not modify the contents of the History file, it merely inserts a blank line at the current position of the cursor in the text field displayed on the screen (only if the bottom line is blank).

F6 Delete Line does not modify the contents of the History file, it merely deletes the line at the current position of the cursor in the text field displayed on the screen

F7 Print History initiates a printout of all of the text stored in the History file.

F8 Save History saves the text displayed on the screen into the History file.

Press F10 to proceed to the System Manager menu (fig.3.13).

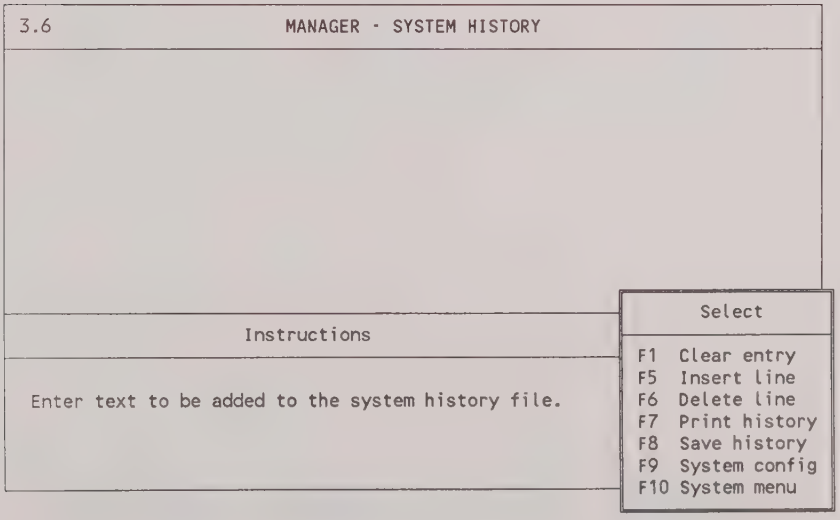


Fig 3.12 Manager - System History Menu

3.2.5 Autostarting of the 4101B

It is recommended that the 4101B software is automatically invoked when the computer is turned on or re-booted (re-started). From the System History menu (Fig 3.12), select F10 to display the System Manager menu (fig. 3.13). Select F10 once more to display the System menu (fig 3.14). On the Compaq II, the C> prompt will appear, while on the IBM XT and HP Vectra controllers, the Portocal Exit menu (fig. 3.15) will be displayed. From the Portocal Exit menu, select F1 (Return to DOS) in order to obtain the C> prompt.

3.2.5.1 For IBM, Compaq II

(HP Vectra users should proceed to paragraph 3.2.5.2)

Type, at the C> prompt,

COPY C:\ PORTOCAL\ AUTOEXEC.BAT C:\ ↵

The computer will then copy the file AUTOEXEC.BAT from the directory PORTOCAL to the root directory. This file causes the 4101B software to start automatically every time the computer is powered up or re-booted.

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The autostarting of the 4101B software will later cure this problem, however, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.
The 4101B software is now correctly installed and the system is ready for calibration work.

3.2.5.1.1 Note for experienced DOS users

The Manager - System Configuration menu will automatically re-create the AUTOEXEC.BAT file in the PORTOCAL directory every time it is invoked, so as to ensure the call to the correct keyboard driver, and thus will not affect the batch file that is in the root directory.

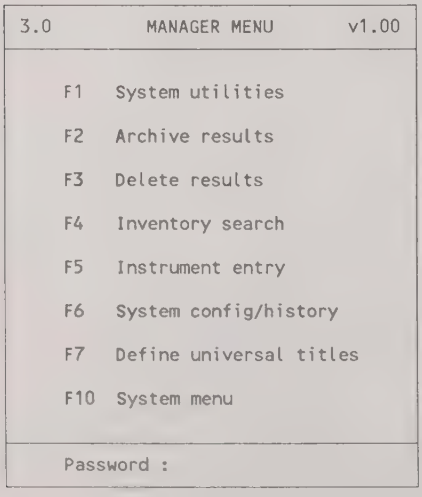


Fig 3.13 System Manager Menu

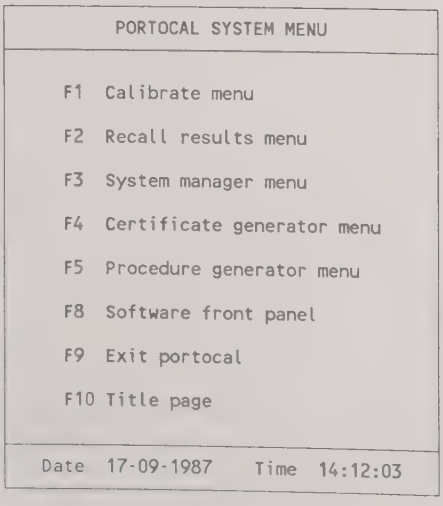


Fig 3.14 System Menu

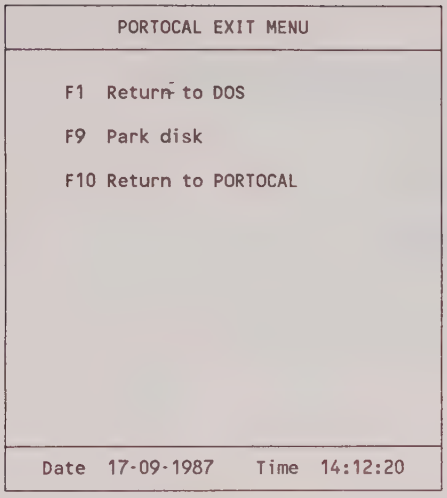


Fig 3.15 Portocal Exit Menu

3.2.5.2 PAM on the HP Vectra

Due to the existence of PAM (Personal Applications Manager), a different technique is required to correctly autostart the 4101B software.

3.2.5.2.1 Modifying the CONFIG.SYS

Obtain the C> prompt, if necessary, by selecting DOS Commands in the PAM main menu, Fig 3.16 (refer to paragraph 3.2.1.2 for details). Type, at the C> prompt,

CD \ ↵

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The autostarting of the 4101B software will later cure this problem, however, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.

COPY CON CONFIG.SYS ↵
(note: the C> prompt will NOT re-appear.)
SHELL=PAMCODE.COM ROOT ↵
BUFFERS=20 ↵
FILES=20 ↵

Press the function key F6, which will cause the characters ^Z to appear, followed by the ↵ key. The C> prompt will now return.

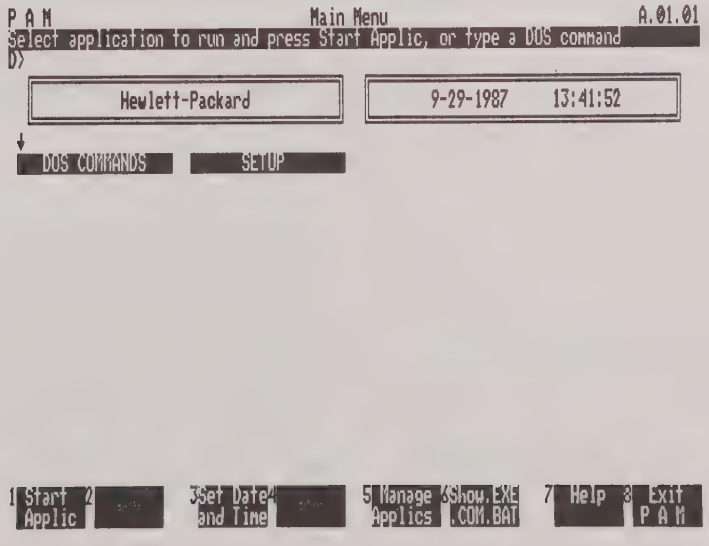


Fig 3.16 PAM Main Menu

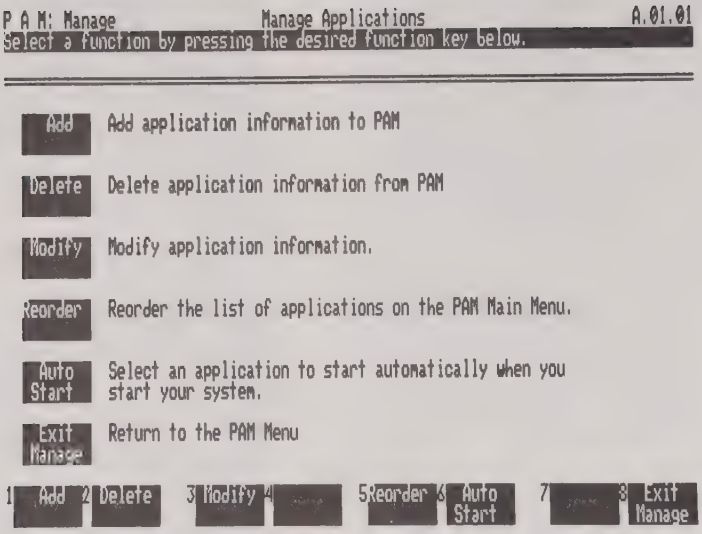


Fig 3.17 PAM Manage Applications Menu

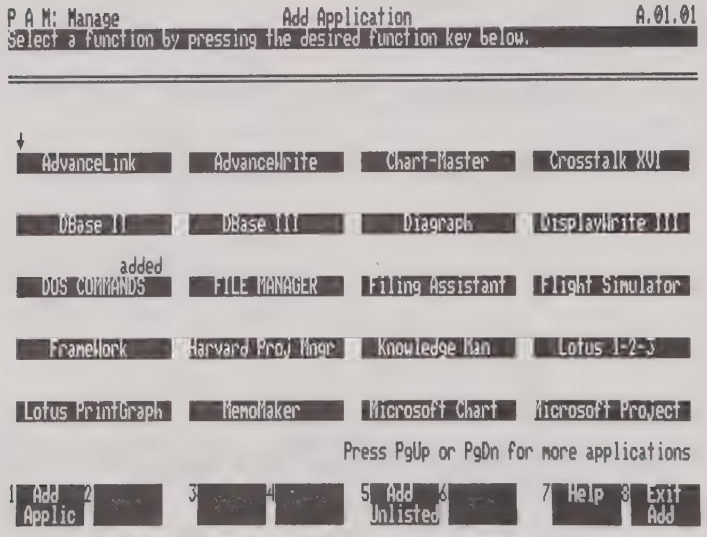


Fig 3.18 PAM Add Applications Menu

3.2.5.2.2 Updating PAM

Re-boot the system (press [Ctrl] and [Alt] simultaneously, and while they are still depressed, press the [Del] key).

The system will boot up and the PAM main menu (fig 3.16) will appear.

Press the function key F5, to display the Manage Applications menu (fig 3.17).
Press the function key F1, to display the Add Applications menu (fig 3.18).
Press the function key F5, to display the Add Unlisted Application menu (fig 3.19), which allows the user to enter details of the application to be added to PAM.

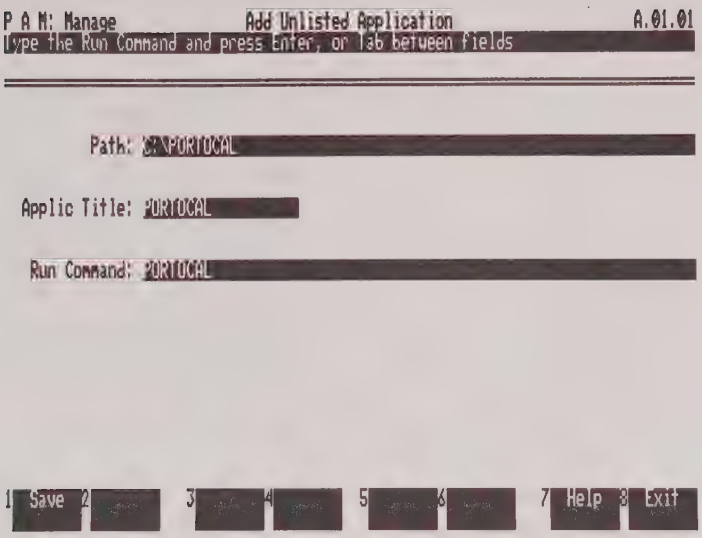


Fig 3.19 PAM Add Unlisted Application Menu

For Path: type C: \ PORTOCAL ↵

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The autostarting of the 4101B software will later cure this problem, however, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.

For Applic Title: type PORTOCAL ↵
For Run Command: type PORTOCAL ↵

When the details entered in this page are correct, press function key F1 to save this information and press function key F8 to exit this menu into the Add Applications menu (fig 3.18).
Press function key F8 to exit this menu and display the Manage Application menu (fig 3.17), and F8 again to display the PAM main menu (fig 3.16).

Now the information about the Portocal application has been entered into PAM, and when the system is re-booted or powered up, the PAM main menu (fig 3.16) will display PORTOCAL as one of the applications available. To run this application, use the cursor control keys on the numeric keypad on the right hand side of the keyboard to move the highlighted cursor over the box displaying PORTOCAL, press the ↵ key, and the application will start.

3.2.5.2.3 Autostarting the Portocal application.

If it is required that the Portocal application starts automatically, then it is necessary to update PAM still further.

From the PAM main menu, press function key F5 to display the Manage Applications menu (fig 3.17).
Press function key F6 to select the Autostart Application menu (fig 3.20).
Use the cursor control keys on the numeric keypad on the right hand side of the keyboard to move the highlighted cursor over the application called PORTOCAL. Press the function key F1 to select this application for autostart.
Press function key F8 to display the Manage Application menu (fig 3.17), and F8 again to display the PAM Main menu (fig 3.16)

3.2.5.2.4 Modifying the AUTOEXEC.BAT

For systems other than one utilizing a US keyboard, it is necessary to have the AUTOEXEC.BAT file call up the correct keyboard driver for the system (see paragraph 3.2.3.13). To create the file required, exit from the PAM Main menu (Fig 3.16) into DOS, by selecting DOS Commands and pressing the ↵ key (refer to paragraph 3.2.1.2).

At the C> prompt, type CD \ ↵

Note: if the \ key does not echo the same character to the screen, the correct keyboard driver has not been invoked. The autostarting of the 4101B software will later cure this problem, however, it is still necessary, at this stage, to obtain the \ character. This may be achieved by pressing the [Alt] key, and while it is still depressed, type 92 on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is released, the \ character will be echoed to the screen.

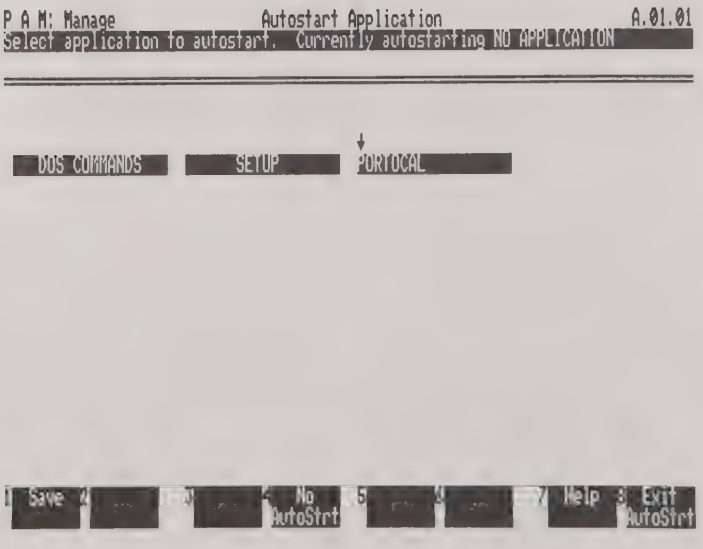


Fig 3.20 Pam Autostart Application Menu

When the C> prompt returns, type:

COPY CON AUTOEXEC.BAT ↵
(note: the C> prompt will NOT re-appear.)
KEYBXX ↵
(where KEYBXX is the name of the correct keyboard driver for your system. Refer to paragraph 3.2.3.13 for possibilities.)

Press the F6 key, which will echo the characters ^Z on the screen, followed by the ↵ key, and the C> prompt will return.

Note: the above instructions are only applicable if the DOS was loaded into the root directory (see paragraphs 3.2.1.3, 3.2.1.4). If this is not the case, then the KEYBUK command above must be modified to include the directory in which the KEYBUK.COM file is resident, eg
C:\DOS\KEYBUK

SECTION 4: SOFTWARE OVERVIEW AND STRUCTURE

4.1 Introduction

The objective of the Portocal software is to allow a user to carry out the following processes without needing to understand how to operate computers or how to write software:

i) Create procedures (a sequence of calibration actions) which can be stored on disk and used repeatedly to calibrate instruments.

ii) To reliably control the system calibrators according to the procedure requirements, to take readings from any type of multimeter, send electronic calibration commands or interact with a technician to instruct on how to carry out adjustments, and to store results on disk and print them out in the form of a calibration certificate.

iii) To be able to track past results and present them for viewing or printout.

iv) To be able to modify the calibration certificate format to suit user requirements.

v) To search through details on instruments calibrated by the system in order to extract management information such as calibration workload during any future period.

4.2 Implementation

In order to achieve the above, the software has been split into five main programs, as in fig 4.1. Details which are created by one program may be used by that program or any of the other programs. All programs and files are physically held on the system's hard disk, though there is provision to transfer information onto floppy disks for long term storage either for security reasons or if space becomes a premium on the hard disk.

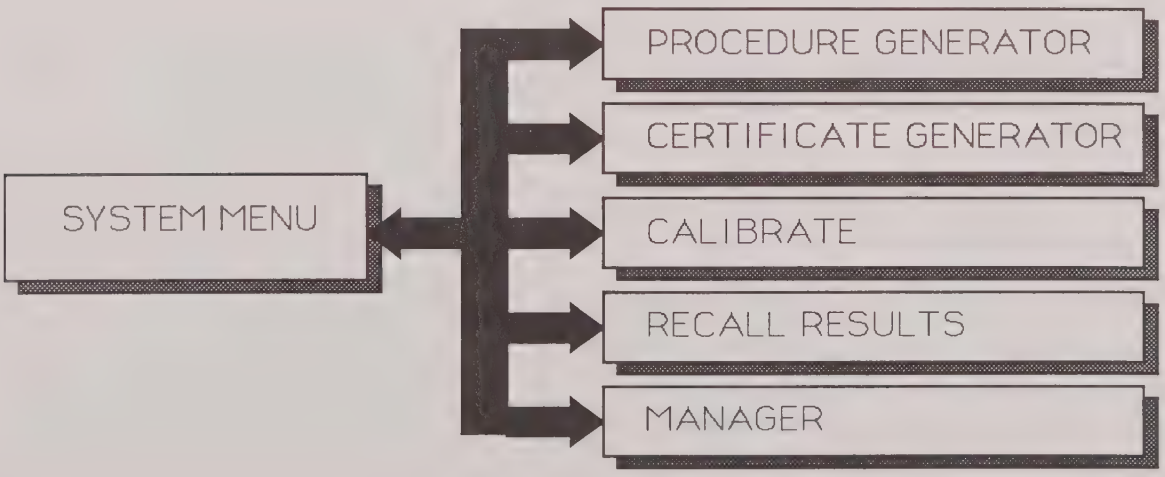


Fig 4.1 4101B Software Structure.

4.3 Programs

The five main programs are:

4.3.1 Procedure Generator

This program is used to create calibration procedures for any type of DMM or analog meter. A series of menus ask questions on how, and against what specifications, the calibration is to be performed. Enough information is given to the system to enable it to carry out the calibration in exactly the desired manner.

Multiple procedures can be developed, edited, tested and stored on disk, so that the calibration technician can then run them repeatedly using the 'calibrate' program.

The procedure details are stored in the Procedure database.

4.3.2 Calibrate

This program allows the operator to select the approved calibration procedure and then forces all subsequent action to follow the defined sequence, causing every calibration performed with that procedure to be identical.

After the calibration run is complete, a print out of the results in the form of a calibration certificate may be obtained.

The calibrate program will read procedure details from the Procedure library, certificate format details from the Certificate library, and store all the results in the Results Files. Prior to any calibration run the System History Files are checked to ensure the system calibrators are themselves within calibration, and use is also made of the Instrument database in order to save time in entering preliminary data.

4.3.3 Recall Results

All the results are stored on the system's high capacity hard disk. The operator can track and search through past results, review them on the screen, and print selections out in the form of calibration certificates.

The Recall Results program reads from the Results database and obtains the certificate design format from the Certificate library.

4.3.4 Certificate Generator

Most users will have their own preferred format of calibration certificate. This section of the software allows the user to modify the standard system calibration certificate and store up to 20 variants on disk for future use.

The Certificate format details are stored in the Certificate library.

4.3.5 System Manager

This program has various functions:

a) Backup of programs and files on the hard disk, either to floppy disk or a tape streamer (option 02).
Formatting of floppy disks.
File Maintenance.
Directory printout.

b) Archiving of selected results onto floppy disk for long term storage, thereby releasing space on the hard disk. (Reading and deleting results from the Results Files).

c) Searching through Instrument Files to find information on the instruments calibrated by the system. The details held in the Instrument Files are updated every time an instrument is calibrated by the system. If required, new instrument details can be fed into the system prior to any calibration activity using the System Manager Program.

d) Entering the history and calibration status of the system's calibrators into the System History Files. The calibrate program will look at these files just prior to running to ensure that the system calibrators are not themselves due for calibration.

e) Redefining the labels attached to the headings and titles used by the screen displays and various printouts, and storing them in the Universal Titles File. This file is then used by all the other programs to modify the terminology presented to the user. For example, the system makes wide use of the descriptive term 'Code Number' throughout the programs. This could be redefined as 'Asset Number' or 'Plant Number' and stored as a Universal Title, which would then be used throughout all programs instead of the words 'Code Number'.

SECTION 5: DRIVING THE SYSTEM.

5.1 Screen Formats

The interaction between the operator and the system is based on the concept of responding to prompts supplied by the program via the monitor screen, in order to enter data.Various prompts are grouped together and presented on the screen in the form of menus.

Each menu generally consists of a series of prompts or questions which need to be responded to in one of three ways:

(i) Alphanumeric data entry,

(ii) Multiple choice selection using function keys,

(iii) Moving past the prompt if it is inappropriate and not mandatory.

Within a page, the ↵ key on the controller keyboard is normally used to take the user to the next prompt in sequence.

The prompts on any particular menu are grouped into blocks, with the various blocks separated by lines. The first prompt in any particular block will generally offer a function key facility to return to the top of the previous block if any corrections need to be made, and a similar function key facility to jump forward to the next block. Otherwise, the ↵ key is used to move forward through the block.

5.1.1 Inverse Video Cursor

An inverse video cursor is used to identify the current position on any particular menu. Its size generally represents the maximum length of the field to be filled in and any attempt to exceed this length will result merely in the overwriting of the last character in the field.

Any existing data for the current position will be shown against the inverse video bar, which may be deleted either through overwriting or using the Backspace key (Alphanumeric Entry) or by selecting a function key (Multiple Choice). If the existing data is acceptable, selection of the ↵ key will move the inverse video bar to the next prompt.

5.1.2 Select Window

At all times the Select Window in the bottom right hand corner of the screen offers the available choice of function keys and their respective uses. The selection offered will vary according to which prompt is currently being considered and also depends upon what information has been previously supplied and what is required.

When enabled, the function keys can be used for the following general processes:

i) Moving from menu to menu

ii) Providing 'answers' to multiple choice prompts.

iii) Coarse movement of the inverse video bar around a particular menu (rather than line by line, using the ↵ key).

iv) Editing facilities for text entry.

5.2 Keyboard Controls

5.2.1 Function Keys

The 4101B software makes maximum use of the function keys for selection of modes and functions. This approach keeps data entry errors to a minimum.

5.2.2 Numeric Entry

Numeric data, when required by the software, may be entered using either the appropriate keys on the top row of the keyboard or the numeric keypad on the right hand side of the keyboard.

To use the numeric keypad, Num.Lock must be first selected to activate the pad. When activated for numeric entry, these keys cannot be used for their other function of cursor control (see below) unless Num.Lock is released.

A decimal point is located on the fourth row of keys, just above the right hand end of the space bar.

5.2.3 Alpha Entry

The normal QWERTY keyboard is equipped with upper and lower case characters, controlled by the shift and Caps Lock functions.
The data allowed by the 4101B software is not limited to characters represented on the keyboard. Any character posessing an ASCII code between 32 decimal and 255 decimal may be entered by pressing the [Alt] key, and while it is still depressed, typing the decimal number corresponding to the desired character on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is release, the character desired will be echoed to the screen.

For a table of the characters available, and their ASCII codes, refer to the relevant manual supplied with your computer.
For IBM-XT users, refer to Appendix D of the BASIC manual.
For HP Vectra users, refer to pages B3 to B13 of the BASIC manual.
For Compaq II users, refer to Appendix B of the MS-DOS Reference Guide.

5.2.4 Cursor Control

One of the features of the 4101B software is a comprehensive text entry and editing facility which is activated where appropriate in the program to allow the user to store and display quantities of text. Such text can be used to provide manual adjustment instructions for the instrument under test, for example.

The following keys may be used to move the cursor freely around the inverse video area on the screen where text entry is allowed.

[↑]	Each press moves the cursor up a line. (CURSOR UP)
[→]	Each press moves the cursor right by one character. (CURSOR RIGHT)
[↓]	Each press moves the cursor down a line. (CURSOR DOWN)
[←]	Each press moves the cursor left by one character. (CURSOR LEFT). Note that this key is different from the backspace key, which is located above the return key
[Home]	Each press moves the cursor to the upper left hand position. (HOME)
[End]	Each press moves the cursor to the lower left hand position. (END)

[PgUp] Each press moves the cursor to the top line in its current column position. (PAGE UP)

[PgDn] Each press moves the cursor to the bottom line in its current column position. (PAGE DOWN)

These keys are all located on the numeric keypad on the right side of the keyboard. The following keys are all located on the main kayboard.

[↵] Each press moves the cursor to the next line, leftmost column. (RETURN)

[←] Each press moves the cursor left by one character (BACKSPACE). Note that this key is different from the left arrow key, which is situated on the numeric entry keypad on the right of the keyboard.

[→\|] Each press moves the cursor right by 8 characters (TAB).

[\|←] Each press moves the cursor left by 8 characters (SHIFT-TAB).

The ability to move the cursor to any part of the permitted text entry field means that text may be laid out as required.

5.2.5 Text Manipulation

The following keys are useful for shifting and amending text when it has been entered:

The [Ins.] key (INSERT) is used to create a space within text at the cursor position, generally in order to insert a character. If the cursor is positioned to the left hand side of a line of text, this key can also be used to shift the entire line of text to the right for positioning purposes. Note that this facility will only be operative if there is no character in the right-most position.

The [Del]. key (DELETE) is used to delete a character at the cursor position. If the cursor is positioned to the left of a line of text, it can also be used to shift the entire line of text to the left for positioning purposes.

When a text entry display is presented to the user, the Select Window for that display will list function keys which may also be used during text entry:

F1 (Clear Entry) clears the text entry field of all previously entered data.

F2 (Initialise Entry) this key will clear the text field of any entered data and write in the default text, if the system has a default text for that particular menu.

F5 (Insert Line) can be used to insert a complete line into existing text. Note that this facility is only operative if the bottom line is blank.

F6 (Delete Line) can be used to delete a complete line from existing text.

Additionally, there are five "hidden" function keys available:

Centralize. The [Shift] and [F3] keys, pressed together, will result in the centralizing of the text on the current line.

Justify. The [Shift] and [F4] keys, pressed together, will result in the left and right justification of the text on the current line.

Copy to Memory. The [Shift] and [F7] keys, pressed together, will result in the copying of the text on the screen into a temporary memory.

Copy from Memory. The [Shift] and [F8] keys, pressed together will result in the copying of the text held in the memory into the current text area. When used with the Copy to Memory function, this can eliminate the requirement to type similar or identical text into numerous menus.

Change Case. The [Shift] and [F9] keys, pressed together, will toggle a "change case" mode. When on, the movement of the cursor with the ← and → cursor control keys will result in each character changing case as the cursor passes underneath. To turn the change case mode to off, press the [Shift] and [F9] keys together.

Graphics characters. The [Alt] and [0 through 9] keys, pressed together, will cause the following characters to be entered at the cursor:

[Alt] [1]: ┌

[Alt] [2]: ┬

[Alt] [3]: ┐

[Alt] [4]: ├

[Alt] [5]: ┼

[Alt] [6]: ┤

[Alt] [7]: └

[Alt] [8]: ┴

[Alt] [9]: ┘

[Alt] [0]: │

[Alt] [-]: ─

These characters allow the entry of rudimantry line drawings.

The graphics character set allowed is not limited to these possibilities. Any ASCII character between 32 decimal and 255 decimal may be entered (see paragraph 5.2.3 for possibilities) by pressing the [Alt] key, and while it is still depressed, typing the decimal number corresponding to the desired character on the numeric keypad on the right hand side of the keyboard. When the [Alt] key is release, the character desired will be echoed to the screen.

SECTION 6: DETAILED SOFTWARE DESCRIPTION

6.1 Introduction

The following sections (7 to 11) address the five main programs that go to make up the 4101B Portocal Software Package.

6.2 Operation

In order to run the software, carry out the following sequence:

i) Power up the controller and its monitor.

ii) For IBM-XT and Compaq II users, if the process outlined in section 3.2.5, entitled "Autostarting the 4101B" has been followed, then the following message will appear.

" If you do not wish to run PORTOCAL then press the [Ctrl] and [Break] keys simultaneously. Otherwise, strike a key when ready ..."

Select [SPACEBAR] and the Portocal Entry page (fig 6.1) will be displayed.

iii) For HP Vectra users, if the process outlined in section 3.2.5, entitled "Autostarting the 4101B" has been followed, then the Portocal Entry page (fig 6.1) will be displayed.

iv) For users of any controller, if the process outlined in section 3.2.5, entitled "Autostarting the 4101B" has NOT been followed, it will necessary to obtain the DOS prompt C>

At this prompt, type

CD \ PORTOCAL ↵
PORTOCAL ↵

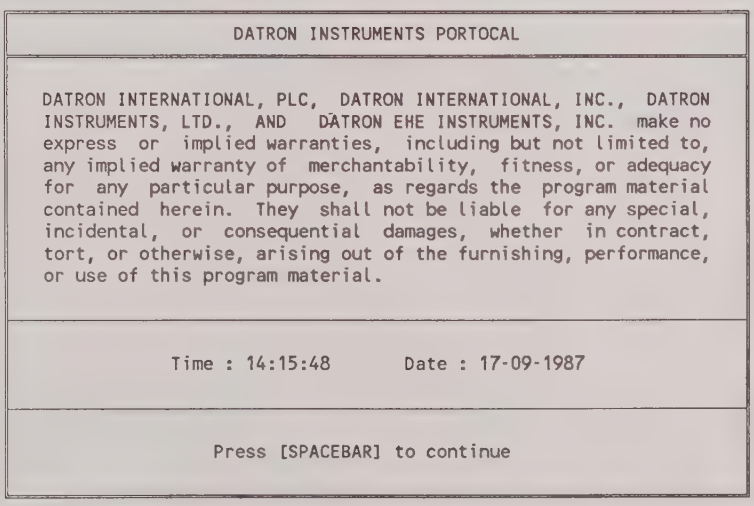

DATRON INSTRUMENTS PORTOCAL
DATRON INTERNATIONAL, PLC, DATRON INTERNATIONAL, INC., DATRON INSTRUMENTS, LTD., AND DATRON EHE INSTRUMENTS, INC. make no express or implied warranties, including but not limited to, any implied warranty of merchantability, fitness, or adequacy for any particular purpose, as regards the program material contained herein. They shall not be liable for any special, incidental, or consequential damages, whether in contract, tort, or otherwise, arising out of the furnishing, performance, or use of this program material.
Time : 14:15:48 Date : 17-09-1987
Press [SPACEBAR] to continue

Fig 6.1 Portocal Entry Page

Fig 6.2 Portocal Title page

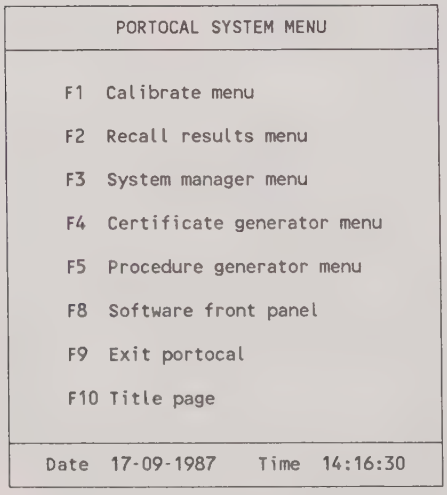


Fig 6.3 System Menu

6.3 System Menu

6.3.1 Introduction

From the Portocal Entry page (fig 6.1), pressing the space bar will cause the Portocal Title page to be displayed (fig 6.2). Depressing the space bar one more time will cause the Portocal System menu (fig 6.3) to be displayed.

The System Menu allows the user to branch into any of the six major programs provided with the system, and also provides the means for exiting Portocal.

6.3.2 Operation

The function keys F1 to F5 and F8 are used to make the required selection of the major programs. The other function keys may be used for the following:

ii) Selection of function key F9 causes the 4101B to invoke the Portocal Exit facility (IBM-XT and HP-Vectra only).

iii) Selection of function key F10 will cause the Portocal Title page (fig 6.2) to be displayed.

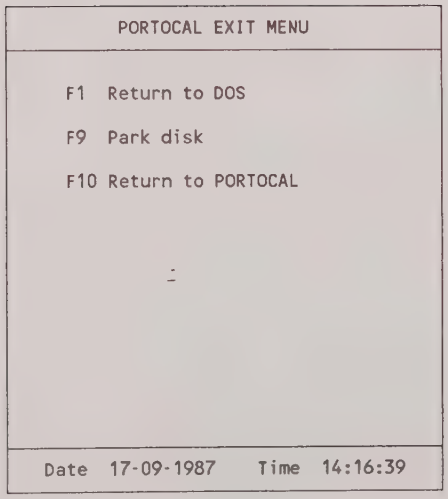


Fig 6.4 Portocal Exit Menu.

6.3.2.1 Portocal Exit

For controllers other than the Compaq II, selection of function key F9 from the System Menu will display the Portocal Exit Menu, fig 6.4. The Compaq II will automatically return to the DOS prompt, C>

For controllers other than the Compaq II, there are three paths of exit from this menu:

i) F1 Return to DOS: For for IBM XT users, selection of this key will return the system to the control of DOS (Disk Operating System), and the C> prompt will appear. From here any other programs that may be resident on the hard disk can be run. (For HP Vectra users, if the process outlined in section 3.2.5 entitled "Autostarting the 4101B" has been followed, the PAM main menu will be displayed.)
From here any other programs that may be resident on the hard disk may be run.

ii) F9 Park Disk: Selecting this key will cause the hard disk to 'park', making it safe to transport. It is important to turn the system controller OFF immediately after the disk has parked. (For HP Vectra users, the sequence of actions is: select function key F1 to get the HP Setup menu. Select 3 followed by the ↵ key to park the disk. Switch the controller OFF.)

iii) F10 Return to Portocal: Selection of this key will return the System Menu (Fig 6.3) to the screen.

SECTION 7: THE CALIBRATE PROGRAM

7.1 Introduction

The Calibrate program allows an operator to identify the instrument to be calibrated, select the approved calibration procedure, and enter details on the conditions at the time of calibration. Subsequently, all actions are forced to follow the defined procedure sequence, causing every calibration performed with that procedure to be identical.

The Calibrate program may be used to run procedures repeatedly and has facilities to aid testing of procedures and print out results either during the run (Real Time Print) or after all the results have been taken.

All results may be stored on the system's hard disk along with user - entered comments which are also printed on the calibration certificate.

7.1.1 Operation

From the System Menu (Fig 7.1), select function key F1 (Calibrate Menu) to display the Calibrate - System Configuration Menu, Fig 7.2

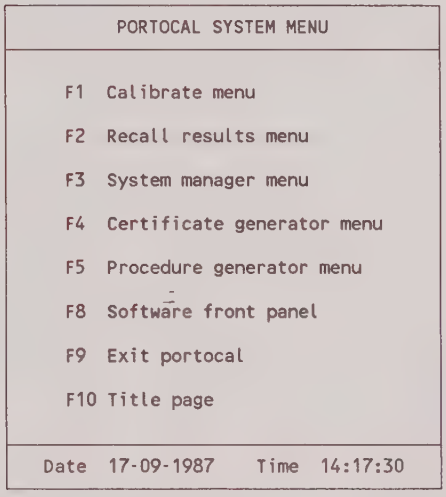


Fig 7.1 Portocal System Menu

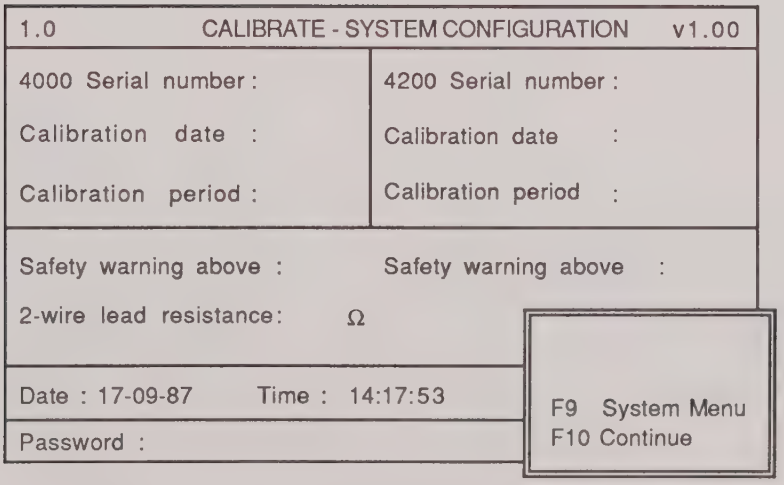


Fig 7.2 Calibrate- System Configuration Menu

When this menu is first displayed, the controller interrogates the system calibrator(s) to ensure the following:

i) That both calibrators are present, set to the correct addresses, and responding over the IEEE-488 interface bus. If there are any problems, a message will be displayed on the screen indicating the area of difficulty.

"99 / 25090 Datron Software Adaptor Missing" indicates that the Software Adaptor was not found by the software. Before the calibration program may be run, the Software Adaptor must be correctly installed. Refer to section 3, paragraph 3.1.

"151 / 25100 IEEE Timeout" indicates that the 4101B software is experiencing difficulties when attempting to communicate with the calibrator(s). The most common cause of this fault is poor cable connections between the secondary IEEE-488 port (when looking at the REAR panel of the controller, the secondary port is the one on the left) and the calibrator(s).

Alternatively, the calibrator(s) may be set to the wrong IEEE-488 address. The address(es) of the calibrator(s) may be checked by depressing the "Error" and "Guard" keys on the front panel of the calibrator(s). A 4000A calibrator must be set to address 4, a 4200A must be set to address 8, and the 4705,4700 and 4707 calibrators must be set to address 2.

If the address(es) of the calibrator(s) are correctly set, and this message persists, it may be due to one of two causes: either the controller's speed ratio has been incorrectly set (refer to section 3, paragraph 3.2.3.16) or the switch settings required by the Ziatech IEEE-488 interface have not been implemented (refer to section 3, paragraph 3.1)

"XXX / 27430", where XXX is any number between 110 and 141, indicates that the calibrator(s) have detected an internal error. These will generally indicate that the calibrator itself is faulty.

ii) The Manager - System Configuration menu (refer to section 3, paragraph 3.2.3.15) allows the user to define which options are available from the system calibrator(s). Each of the options that is defined as being available is tested, and if an option is found to be unavailable, a message:

"Warning ! XXXX unavailable", where XXXX represents the optional facility concerned, is momentarily displayed on the bottom line of the screen.
If the "continue" option is chosen, then the 4101B will attempt to continue, but the user should be aware that if, while running a calibration procedure, a stimulus is selected which the calibrator is not capable of sourcing, the user will be informed of this fact, and the only course of action allowed is to abort from the procedure.

iii) That the serial numbers, calibration dates and calibration periods stored in each calibrator's internal non - volatile memory agree with the system configuration data stored on the system disk. This makes sure that only the approved calibrators are used with the system.

The message: "Warning - XXXX Unrecognised", where XXXX represents the model number of the calibrator involved, indicates that the serial number, calibration dates and calibration period stores in the calibrator are empty. To rectify this situation, refer to section 3, paragraph 3.2.4.2, "Installation of the Calibrator(s)" for the sequence required to install the calibrator(s).

The message: "Warning - XXXX Changed", where XXXX represents the model number of the calibrator involved, indicates that the serial number, calibration date and calibration period read from the non-volatile memory of the calibrator does not agree with the corresponding data stored in the 4101B database. To rectify this situation, refer to section 3, paragraph 3.2.4.2, "Installation of the Calibrator(s)" for the sequence required to install the calibrator(s).

iv) That the calibrators themselves do not require re-calibration.
The message: "Warning - XXXX Out of Cal", where XXXX represents the model number of the calibrator involved, indicates the last calibrated date and the calibration period read from the non-volatile memory of the calibrator, when added together, fall before the current date.
If the current date is incorrect, refer to section 3, paragraph 3.2.4.2.7 for the sequence required to modify the current date.

If, however, the calibrator(s) are due for re-calibration, the system may still be used for running calibration procedures (after the System Manager password has been entered), for example, to debug and develop calibration procedures. Periodic re-calibration is necessary, however, to maintain the tracability of the system.

v) If all seems in order, then selection of function key F10 (Continue) will cause the Calibrate Menu (Fig 7.3) to be displayed, while selection of function key F9 will cause the return of the System Menu (Fig 7.1). This lists a series of prompts which need to be answered to ensure that the correct procedure is used and that all the relevant details appear on the calibration certificate.

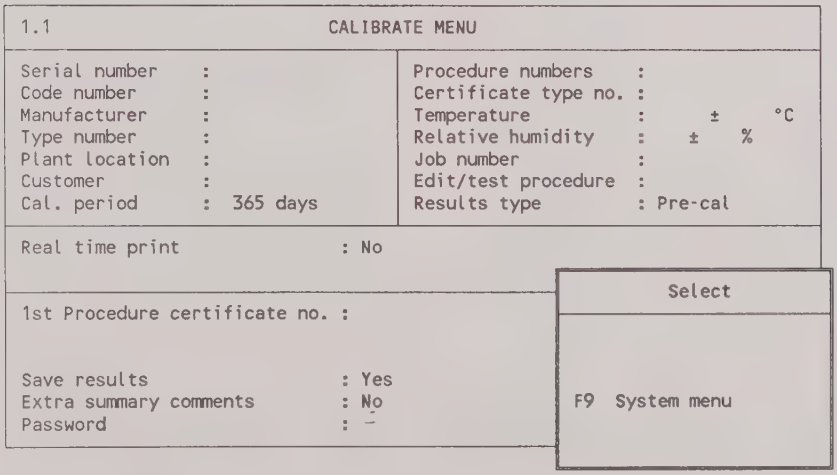


Fig 7.3 Calibrate Menu

7.1.2 The Calibrate Menu.

The overall objective of this page is to inform the system of the details of the instrument to be calibrated.

Instrument details are stored in the instrument database, indexed by a combination of the serial number and the code number. More than one instrument may posess the same serial number, in which case, they must be differentiated by a unique code number. Conversely, more than one instrument may posess the same code number, in which case, they must be differentiated by a unique serial number.

If the instrument has been calibrated by the system before, or if the instrument details have previously been entered using the Manager Menu - Instrument Entry facility, then the combination of serial number and code number will be recognised by the system.
In such cases, all of the information that was previously entered will be automatically recalled from the instrument files and displayed on the screen, to be reused or edited as appropriate. A message "WARNING! Editing existing data" will appear on the bottom line of the display to indicate that any changes made to the data on this page will alter data that is already stored in the instrument database.

If the instrument is not recognised by the system, then certain information must be entered before calibration can begin. The system requires a minimum of: either a serial number or a code number or both (the combination of which must be unique), a calibration procedure or procedures to run and a certificate format in which to place the results obtained. The other details entered in the calibration menu page are optional, and if specified, will be saved to either the results library, the instrument database or both, as applicable.

In either case, when the Run Procedure(s) function key is invoked, the details entered in this page will be saved to the instrument database.

7.1.2.1 Serial Number.

The first prompt requires the instrument serial number to be entered, followed by the ↵ key. The serial number entered here will later be stored in the calibration results file, printed on any calibration certificates and, if applicable, saved into the instrument database.

If the Barcode reader is enabled, then the serial number may be entered by passing the barcode reader wand over the barcode, and pressing the ↵ key with the data read displayed.

If the serial number entered is recognised by the system, the details of the instrument with the "lowest" code number (in ASCII sequence) will be recalled from the instrument database and displayed on the screen. If there are other instruments with the same serial number, then proceeding to the code number field will enable the user to differentiate between instruments with the same serial number, but different code numbers.

7.1.2.2 Code Number

This prompt requires the instrument code number (ie Plant Number or Asset Number) to be entered, followed by the ↵ key. The code number entered here will later be stored in the calibration results file, printed on any calibration certificates and, if applicable, saved into the instrument files.

The code number, like the serial number, may be entered by the Barcode reader, if enabled.

If the instrument serial number and code number are unrecognised by the system, then each prompt in the page will remain blank, and the user has the opportunity to enter the rest of the information as required.

If the instrument serial number was recognised, but more than one instrument exists with that serial number, the instrument with the lowest code number (in ASCII order) will be displayed. If the code number is changed to that corresponding to another instrument, then the data on the displayed page will change accordingly.

If the instrument serial number was left blank, and the code number entered recognised by the system, then the instrument with the lowest serial number (in ASCII order) will be displayed. The serial number may then be changed to call up the instrument required.

7.1.2.3 "Hidden" function keys.

When the inverse video cursor is located over the serial number or code number fields, and either a serial number or code number that the system recognises has been entered, then there are six "hidden" function keys that enable the user to step through the instrument files containing the data for each individual instrument:

i) Decrement Serial Number. The [Shift] and [F3] keys, when pressed together, will cause the information from the instrument with the previous serial number, in ASCII order, to be displayed.
When the first instrument is reached, the message "This is the first serial number" will be displayed and further depression of the [Shift] and [F3] keys will not cause any further action. If an instrument with a blank serial number is currently displayed, then selection of this facility will cause the message "No Serial no. selected" to be displayed.

ii) Increment Serial Number. The [Shift] and [F4] keys, when pressed together, will cause the information from the instrument with the next serial number, in ASCII order, to be displayed.
When the last instrument is reached, the message "This is the last serial number" will be displayed and the further depression of the [Shift] and [F4] keys will not cause any further action.If an instrument with a blank serial number is currently displayed, then selection of this facility will cause the message "No Serial no. selected" to be displayed.

iii) Decrement Code Number. The [Shift] and [F5] keys, when pressed together, will cause the information from the instrument with the previous code number, in ASCII order, to be displayed.
When the first instrument is reached, the message "This is the first code number" will be displayed, and the further depression of the [Shift] and [F5] keys will not cause any further action. If an instrument with a blank code number is currently displayed, then selection of this facility will cause the message "No Code no. selected" to be displayed.

iv) Increment Code Number. The [Shift] and [F6] keys, when pressed together, will cause the information from the instrument with the next code number, in ASCII order, to be displayed.
When the last instrument is reached, the message "This is the last code number" will be displayed, and further depression of the [Shift] and [F6] keys will not cause any further action. If an instrument with a blank code number is currently displayed, then selection of this facility will cause the message "No Code no. selected" to be displayed.

v) Display the previous instrument. The [Shift] and [F7] keys, when pressed together, will cause the information from the record in the instrument inventory immediately preceding the current instrument to be displayed. When the first instrument is reached, the message "This is the first instrument" will be displayed, and further depression of the [Shift] and [F7] keys will not cause any further action.

vi) Display the next instrument. The [Shift] and [F8] keys, when pressed together, will cause the information from the record in the instrument inventory immediately after the current instrument to be displayed. When the last instrument is reached, the meassge "This is the last instrument" will be displayed, and any further depression of the [Shift] and [F8] keys will not cause any further action.

Note that the order in which the instruments are displayed when using the Shift-F7 and Shift-F8 functions is altered by the File Maintenance program (refer to Section 11, paragraph 11.3.2.4)

7.1.2.4 Manufacturer

Enter the make of the instrument (e.g. Datron), if required, and select the ↵ key. The data entered here will later be stored in the calibration results file, printed on any calibration certificates and saved into the instrument database.

7.1.2.5 Type Number

Enter the type or model number of the instrument (e.g. 1061A), if required, followed by the ↵ key . The data entered here will later be stored in the calibration results file, printed on any calibration certificates and, if applicable, saved into the instrument database.

7.1.2.6 Plant Location

Enter the area or factory that the instrument is normally situated in, if required, followed by the ↵ key. The data entered here will later be stored in the calibration results file, printed on any calibration certificates and, if applicable, saved into the instrument database.

7.1.2.7 Customer

Enter the details of the customer for the calibration, if relevant, followed by the ↵ key. If ignored, then this detail will not appear on the calibration certificate. The information data entered here will later be stored in the instrument database.

7.1.2.8 Note on "Universal Titles"

All of the prompts mentioned in sections 7.1.2.1 to 7.1.2.7 and 7.1.2.14 may be relabelled using the Manager - Universal Titles Menu (section 11, paragraph 11.9). For example, the title 'Plant Location' can be easily changed to 'Department' using this Manager facility.

7.1.2.9 Cal. Period

Enter the period in days for which the calibration will be valid, followed by the ↵ key. This will ensure that the system can keep track of the status of the instrument's calibration, (which the user can access in a variety of ways via the Manager Menu), and will also print out the correct recommended recalibration date on the calibration certificate. The cal. period entered here will later be stored in the instrument database.

7.1.2.10 Procedure Numbers

The required calibration procedure(s) may now be specified. Up to three procedures may be selected, each a numeric entry followed by the ↵ key. Multiple procedure numbers entered in this way will cause the specified procedures to be chained together, so that it is possible to carry out a verify - calibrate - verify sequence. Alternatively, if only a single procedure is required, enter the number and then press the ↵ key twice.

If the required procedure number is unknown, selection of function key F1 (Procedure Library) will display the first page of 20 procedures contained in the Procedure Library (Fig 7.4). All 999 possible procedure numbers may be accessed using the F1 (Next Page) and F3 (Page Select) function keys and the appropriate procedure number(s) selected. When the correct procedure(s) have been entered, the F10 key is used to return to the Calibrate menu (Fig 7.3).
The procedure number(s) entered here will later be stored in the appropriate record in the results library, and saved into the instrument database.

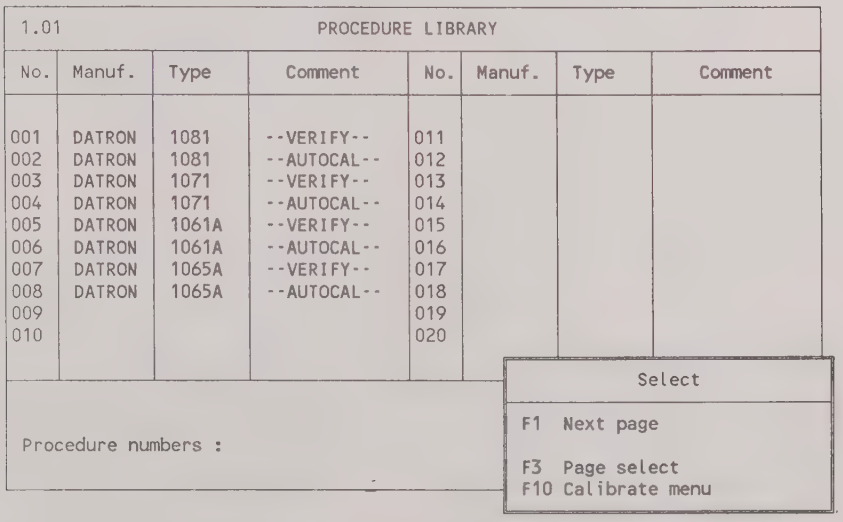


Fig 7.4 Calibrate - Procedure Library Menu

7.1.2.11 Certificate Type Number

Enter the number of the required calibration certificate format, followed by the ↵ key. To aid recall, selection of function key F1 (Certificate Library) will display the Certificate Library Menu (Fig 7.5) which will list up to 20 alternative certificate formats. When the certificate format entered is correct, the F10 key is used to return to the Calibrate menu (Fig 7.3). The certificate format entered is stored in the instrument database.

The system is provided with two Datron designed certificate formats. Certificate 1 is identical to the system DEFAULT certificate, and is suitable for IEEE-488 controlled instruments. Certificate 2 is more suited to manually controlled DMMs. (Refer to section 10, paragraph 10.1.1 for further information.)

7.1.2.12 Temperature

Enter the ambient temperature for the calibration, if required. The temperature entered here will later be stored in the calibration results file, printed on any calibration certificates and saved into the instrument database.

7.1.2.13 Relative Humidity

Enter the ambient humidity for the calibration. The relative humidity entered here will later be stored in the calibration results file, printed on any calibration certificates and saved into the instrument database.

7.1.2.14 Job Number

If relevant, enter the job number associated with the calibration. The job number entered will be stored in the calibration results file and printed on any calibration certificates.

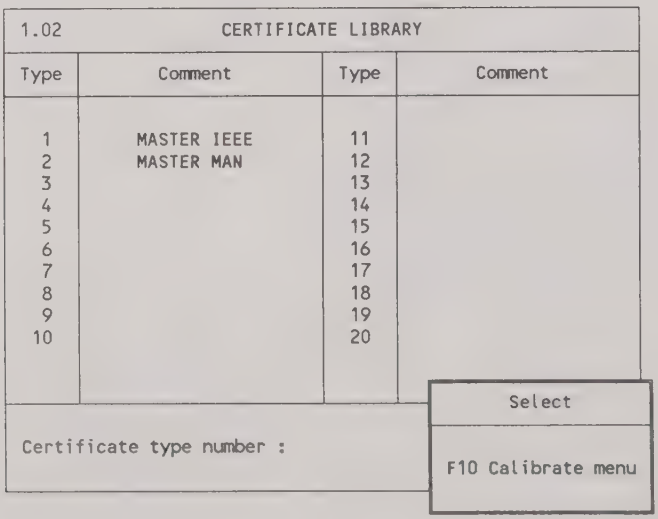


Fig 7.5 Calibrate - Cerificate Library Menu

7.1.2.15 Edit / Test Procedure

Selection of function key F1 (Edit / Test) - (or F2 or F3 if more than one procedure is going to be run sequentially) - will cause a cursor to flash against the password prompt. Correct entry of the Calibrate password will display the Edit / Test Procedure Menu (Fig 7.6). This menu has two main functions:

i) Edit: The operator is allowed to delete certain functions from the procedures to be executed, thereby allowing him to calibrate (for example) only the DCV function of an instrument, using a procedure which is capable of calibrating more than one function.
Note that this in no way alters the original procedure which is held in the procedure files.
To make use of this facility, select Yes or No, using the function keys F1 and F2 as appropriate, followed by the ↵ key against all of the listed available functions.

ii) Test: The procedure may be run in two ways: Continuous or Step.
When the Continuous Sequence Mode is selected, the procedure is run at its normal speed. This may be quite fast for totally automated procedures.
However, when the selected Sequence Mode is Step, the procedure is executed line by line and requires manual intervention (by selecting function key F10) to move from testpoint to testpoint. The Step Mode is used to aid the debugging of procedures by providing pauses at each testpoint to allow inspection of the procedure performance when a problem is suspected.
To operate, make the appropriate choice from the Select Box when the inverse video bar is sitting at Sequence Mode, followed by the ↵ key.
When the required functions and Sequence Mode have been selected, press function key F10 (Calibrate Menu) to return to the Calibrate Menu (Fig 7.3)

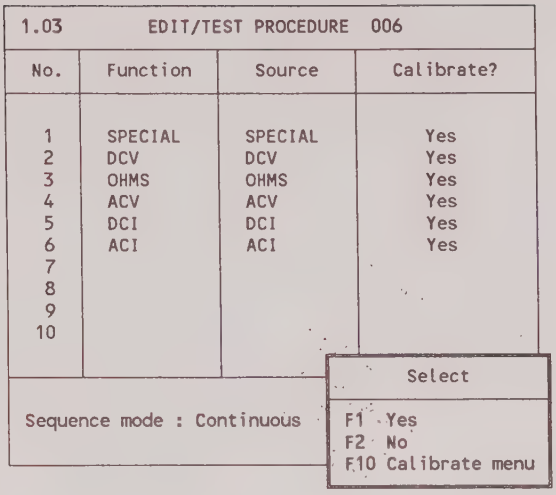


Fig 7.6 Edit / Test Procedure Menu

7.1.2.16 Results Type

If the sequence of selected procedures does not tell the system whether the results to be taken will be either pre or post adjustment, an appropriate choice from the Select Window needs to be made, so that the correct comment will automatically appear on the calibration certificate title page. (Refer to, section 10, paragraph 10.4.7 for further information). The results type entered here will later be stored in the calibration results file and printed on any calibration certificates.

7.1.2.17 Real Time Print

If function key F1 (Yes) is selected, then the system will print out results, testpoint by testpoint as they are actually taken from the instrument under test, in a compact format (as opposed to printing them out all at the same time in the form of a calibration certificate, after the tests are complete).

Real Time Print will slightly increase the calibration time, and is really intended to be an aid to debugging procedures. The print out format is fixed and minimal, linking each result to the relevant test point number of the procedure, thus providing a method of tracing unusual results back to the appropriate section of the procedure that caused them.

7.1.2.18 Instrument IEEE Address

If 'AUTO' is left selected for this prompt, the system will automatically seek and find the IEEE-488 address of the instrument under test providing it is greater than 0 and less than 31, and that the instrument under test is the ONLY instrument connected to the bus. Note that the Auto address search routine used relies on the controller attempting to communicate with the instrument-under-test, and either obtaining a response (in which case the address has been found and the calibration procedure continues) or detecting an IEEE handshake timeout. Therefore, if multiple instruments are connected to the primary (or instrument - under-test) port, then F2 (Manual select) must be used to inform the 4101B software of the address of the instrument.

Enter the appropriate choice, followed by the ↵ key.

7.1.2.19 Certificate Number

This field is unconnected with the Certificate Type Number field (paragraph 7.1.2.11), in that the Certificate Type Number defines the calibration certificate format to be used when printing calibration results.

This field, the Certificate Number, will later be stored in the calibration results files for this particular set of results, and will appear on any calibration certificates printed. This may be used to uniquely identify a particular set of calibration results.

If more than one procedure has been selected, then the equivalent number of Certificate Number entries are prompted for.

7.1.2.20 Save Results

As the Calibration program takes results from each testpoint tested, these results are stored in a temporary file. At the end of the calibration procedure, or sequence of procedures, has run, these results are copied into the results library and the last calibrated date stored in the instrument files is updated to the current date.

Selection of function key F2 (No), followed by the ↵ key will prevent this happening. Opting not to save results does not prevent printing out or reviewing the results at the end of the procedure, but will prevent the updating of the last calibrated date stored in the instrument database. The implications of the selection made here are discussed in section 11, paragraph 11.6.2.5

7.1.2.21 Extra Summary Comments

Selection of function key F1 (Yes), will display the Extra Summary Comments Menu (Fig 7.7) where text may be entered by the operator. The various editing facilities available are detailed in section 5, paragraph 5.2.

This text is later stored in the results files, printed on the calibration certificate, and may be used to make comments on the initial state of the instrument. If more than one procedure is selected, the same text is stored with the results of each procedure.

This Summary Comments Menu, together with the text entered here, is also accessible after the calibration procedure has been run, so that further comments on how the calibration proceeded may be entered. In this case, if more than one procedure has been chained together and run, then different text comments can be stored and printed with the results from the different procedures.

When the Summary Comments have been entered, press F10 to return to the Calibration Menu.

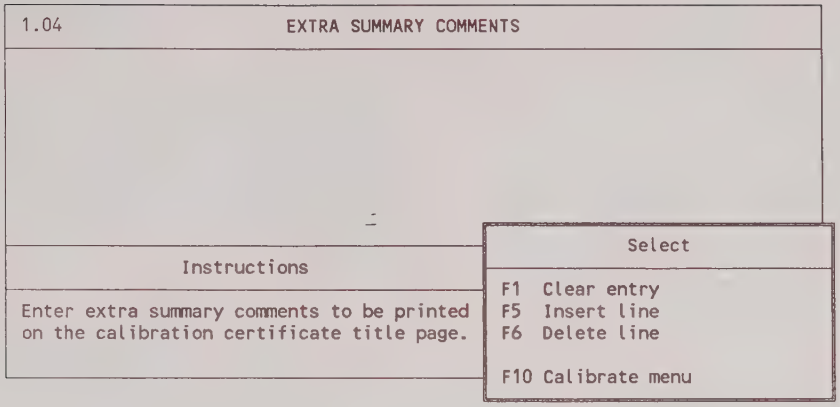


Fig 7.7 Extra Summary Comments Menu

7.1.2.22 Password Protection

The Manager - Instrument Entry Menu allows an authorised user to password protect the details held in the instrument files. This means that if they are amended in the Calibrate Menu, the procedure cannot be run without first entering the Calibrate password.

When an instrument is to be calibrated it will be regarded by the system as being in one of three classes:

i) Totally new instruments. If the instrument has never been calibrated by the system and, furthermore, no details have been entered in the Manager - Instrument Entry Menu, then it will be totally new. Entry and editing of details is uninhibited and the only item requiring password entry is Edit / Test Procedure.

ii) Instrument already on file, not password protected. If the instrument is known to the system, but it has not been password protected, then again, Edit / Test Procedure requires a password, and serial number or code number cannot be changed unless the Manager - Instrument Entry Menu is used. All other details can be changed if required.

iii) Instrument already on file, password protected. When an operator has typed in the serial number (or code number) which the system recognises as being a password protected instrument, NOTHING may be edited or changed in the Calibrate Menu and then a procedure run without first entering the Calibrate password. The exceptions to this are Temperature, Relative Humidity, Job Number, Real Time Print, Instrument IEEE address, Certificate Number(s), Save Results and Extra Summary Comments.

iv) At all times selection of function key F9 (Pause) will cause the system to complete the current reading and then stop. Various function keys are then enabled to permit repetition of test points if desired:

a) F10 (Continue): To continue to the next test point in the sequence.

b) F1 (Freq): To repeat the current test frequency (if the function is AC).

c) F3 (Value): To repeat the current test value (which may include several frequencies if the function is AC).

d) F5 (Range): To repeat all test points from the start of that range.

e) F7 (Function): To repeat all test points from the start of that function.

Note that previously noted test values will be overwritten by any repeated test point values, both on the screen, and in the results files stored on disk.

v) At any time, selection of [Esc] (Abort) will abort the calibration. The operator will be given the option to save or not save the results obtained up until that point to the results database (if the Save Results = Yes option was chosen). Selecting F10 (Yes) will save the results, but will suppress modifying the last calibrated date field in the instrument inventory. Note that if the option to not save the results (F1) is chosen, the opportunity to display and print those results will still be available.

7.3.3 Manual Type Procedures.

i) The top and middle parts of the Calibration In Progress menu (Fig 7.10) are identical to the IEEE-488 or Electronic Calibration Type Menu except the number of readings shown is limited to the last three.

ii) The instruction window is larger to accomodate not only connection instructions, set up instructions and adjustment instructions as defined in the Procedure Generator, but also a special instruction display for taking readings from the instrument under test. When the instrument under test has no IEEE-488 interface, the readings are taken from the instrument under test by adjusting the calibration source output until the instrument reads the desired value. The system then reads the true value from the calibration source and therefore computes the error in the measurement.

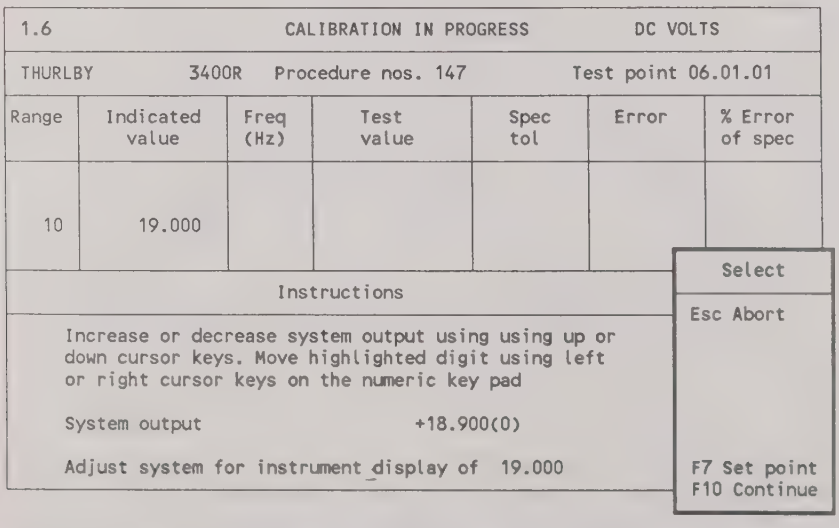


Fig 7.10 Calibration In Progress Menu (Manually Controlled Procedures)

The operator varies the output of the calibration source by using the ←, →, ↑ and ↓ cursor control keys situated on the numeric keypad on the right hand side of the keyboard (note that the 'Num Lock' toggle must be off). The ← and → keys are used to highlight a particular digit on the numeric representation of the calibrator output, while the ↑ and ↓ keys increment and decrement that digit as applicable, with full borrow and carry function.

Where the resolution of the calibrator allows, the operator is given one more digit of resolution than the instrument-under test posesses, so as to give greater accuracy to the reading "taken".

When using an AC source, the calibrators place a limitation on the output levels available. The calibrator's specifications apply between 9% and 200 % of range, therefore any attempt to decrement the output of the calibrator to below 9% of range will result in an output value of 0.

At any time, function key F7 (Set Point) can be used to return the calibration source output to the nominal demanded output.

When the cursor control keys are used to ramp the system output upwards and the output value reaches the Full Scale Value, as defined in the Procedure Generator (section 9, paragraph 9.10.9), the system allows the output to climb to 10% of Full Scale Value above Full Scale Value. For example, if the Full Scale Value is 2.000 volts, then the output is allowed to ramp as high as 2.200 volts before it is clamped, limiting the possibility of causing damage to the instrument.

iii) When the instrument under test is displaying the required value (Indicated value) selection of function key F10 (Continue) will display a select box which gives the operator the following choices:

a) F10 (Continue): To continue to the next test point
b) F1 (Freq): To repeat the current test frequency (if the function is AC).
c) F3 (Value): To repeat the current test value (which may include several frequencies if the function is AC).
d) F5 (Range): To repeat all test points from the start of that range.
e) F7 (Function): To repeat all test points from the start of that function.

Previously noted test values will be overwritten by any repeated test point values, both on the screen, and in the results files stored on disk.

7.4 Recall Results Menu

7.4.1 Introduction

When the calibration procedure has been completed the Recall Results Menu (Fig 7.11) is displayed. This menu allows the operator to review the results on the screen, add or change Extra Summary Comments, print calibration certificates, and transfer results to files on hard or floppy disks or to another computer via the RS 232 interface. These functions are available, even if the calibration run was aborted and the operator selected not to save the calibration results obtained.

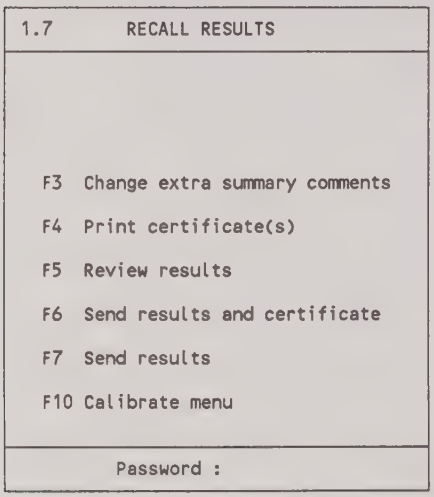


Fig 7.11 Recall Results Menu

7.4.2 Operation

7.4.2.1 Change Extra Summary Comments

Selection of function key F3 (Change Extra Summary Comments) will display the Change Extra Summary Comments Menu (Fig 7.12), which will list up to 3 procedures (which may have been chained together) along with summaries of numbers of testpoints, fails and borderline results for each procedure.

(Note: 'Borderline' is set up in the Certificate Generator (section 10, paragraph 10.5.3.2) and allows the user to select a certain percentage of the instrument under test's specification. Should any results taken have errors which are greater than the borderline point but less than the fail point, then those results are deemed to be borderline)

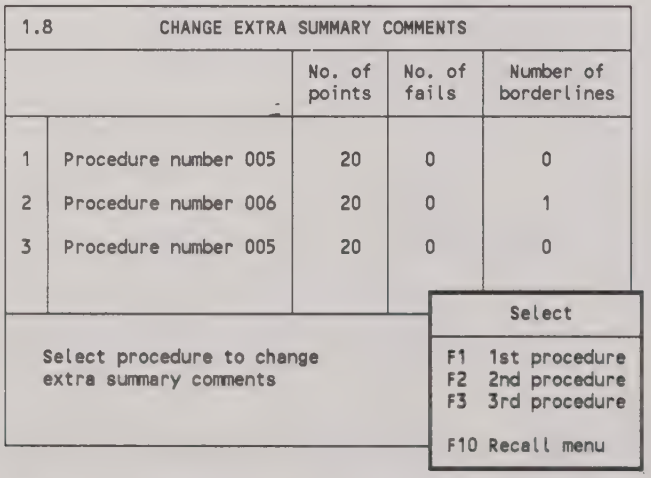

1.8 CHANGE EXTRA SUMMARY COMMENTS
No. of points
No. of fails
Number of borderlines
1 Procedure number 005 20 0 0
2 Procedure number 006 20 0 1
3 Procedure number 005 20 0 0
Select procedure to change extra summary comments
Select
F1 1st procedure
F2 2nd procedure
F3 3rd procedure
F10 Recall menu

Fig 7.12 Change Extra Summary Comments Menu

Selection of the function key (F1, F2 or F3) associated with the procedure whose results are to have the summary comments attached will display the Recall Results - Extra Summary Comments Menu (Fig 7.13). This will already be displaying any text which may have been entered from the Calibration Menu before the calibration run (using Extra Summary Comments), which may be amended and added to. The text editing facilities described in section 5, paragrah 5.2 are available in this menu. Any comments entered here are stored with the results and are printed on the calibration certificate.

Selection of function key F10 (Change Comments Menu) will display the Change Extra Summary Comments Menu (Fig 7.12), and further selection of function key F10 (Recall Menu) will return the Recall Results Menu (Fig 7.11) to the screen.

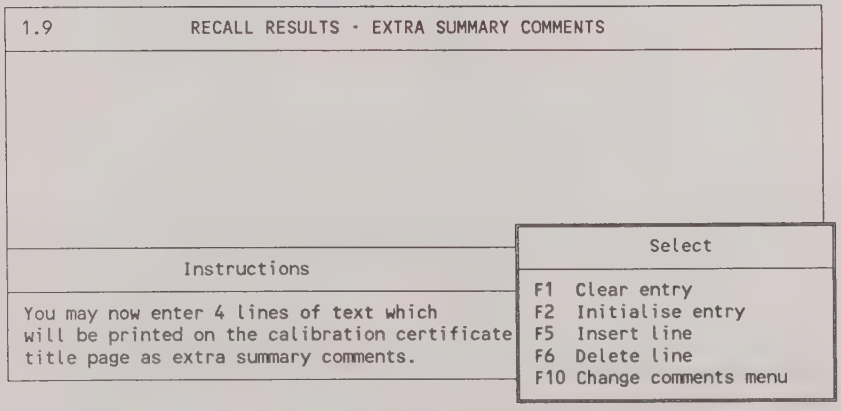

1.9 RECALL RESULTS - EXTRA SUMMARY COMMENTS
Instructions
You may now enter 4 lines of text which will be printed on the calibration certificate title page as extra summary comments.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Change comments menu

Fig 7.13 Recall Results - Extra Summary Comments Menu

7.4.2.2 Print Certificate(s)

Selection of function key F4 (Print Certificate(s)) will display the Print Certificate Menu (Fig 7.14) which will list a summary of up to 3 procedures which may have been chained together.

Function keys F1,F2 and F3 allow the selection of the results from the first, second and third procedures procedures, respectively (if applicable), while F4 allows the selection of the results from all of the procedures run, if applicable.

The prompt "How many copies" will appear. Enter the number of copies required, followed by the ↵ key.

A choice will then be offered as to the type of printout required:

F1 Title Page only.
F2 Results only (a set of results in a compressed format, similar to 'Real Time Print').
F3 Full Certificate (the full set of results including the Title page).

Select the required printout format using the relevant function key and the printout will begin. At any time, function key F6 will abort the printout and cause the printer to perform a page eject.

When printing has finished, function key F10 displays the Recall Results menu, Fig 7.11.

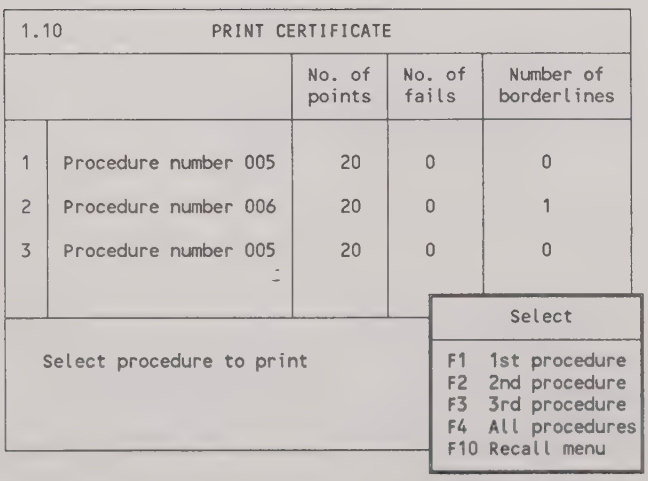


Fig 7.14 Recall Results - Print Certificate Menu

7.4.2.3 Review Results

Selection of the F5 key (Review Results) from the Recall Results Menu (Fig 7.11) will display the Results Summary (Fig 7.15), where up to 3 procedures which may have to be chained together are listed. This summary also indicates how many testpoints, borderline passes and failures occurred for each procedure.

Choosing the function key (F1, F2 or F3) associated with the procedure whose results are to be viewed will display the Review Results Menu (Fig 7.16).

Up to five lines of results are shown at any one time. Function keys F1 to F4 allow the testpoints of interest to be displayed.

Selection of function key F10 (Results Summary Menu) will return the Results Summary Menu (Fig 7.15) to the screen. Further selection of function key F10 (Recall Menu) will display the Recall Results Menu (Fig 7.11).

1.12 RESULTS SUMMARY

		No. of points	No. of fails	Number of borderlines
1	Procedure number 005	20	0	0
2	Procedure number 006	20	0	1
3	Procedure number 005	20	0	0

Select procedure to review

Select

F1 1st procedure
F2 2nd procedure
F3 3rd procedure

F10 Recall menu

Fig 7.15 Recall Results - Results Summary Menu

1.13 REVIEW RESULTS DC Voltage

DATRON 1061 Procedure nos. 005 006 005 Test point 02.02.01

Range	Test value	Freq (Hz)	Indicated value	Spec tol	Error	% Error of spec
10	0.0000		0.0000	±0 d	0 d	<1
10	10.0000		+10.0000	±0 ppm	0 ppm	<1
10	-0.0000		0.0000	±0 d	0 d	<1
10	-10.0000		-10.0000	±0 ppm	0 ppm	<1
100m	0.000m		0.000m	±1 d	0 d	<1

Instructions

Select

F4 Next test point
F10 Results summary

Fig 7.16 Recall Results - Review Results Menu

7.4.3 Results Transfer

7.4.3.1 Introduction

The Portocal system normally stores results in a compressed format on the controller's hard disk. This has the advantage of saving space on the disk, but prevents the user from investigating and manipulating the results files using his own programs. The 'Send Results' and 'Send Results and Certificate' facilities allow the user to transfer results in one of several different ways:

i) As a simple ASCII file on floppy disk.

ii) As an ASCII file based on a complete certificate design on floppy disk.

iii) As (i) and (ii) but as files on the hard disk.

iv) As (i) and (ii) but transferred to another computer via the RS-232C communications interface.

(Note: This method of results transfer does not permit results taken from one Portocal system to be loaded into the results files of another Portocal system. The purpose of these facilities is to allow the user to generate programs which can manipulate results files in ASCII format to provide such facilities as totally customized print formats, for example.)

7.4.3.2 Send Results & Certificate

Selection of function key F6 (Send Results & Certificate) will display the Send Results & Certificate Menu (Fig 7.17), where a summary of up to three sets of results which may have been chained together at the time of calibration will be displayed.

i) Select Procedure Number: Against this prompt the user selects which set of results are to be sent by hitting the appropriate function key.

ii) Transfer Medium: The select box offers the choice of transferring the results of the calibration to hard or floppy disk (function key F1), or to the RS-232C communications port (function key F2).

7.4.3.2.1 Send to Disk

If transfer to disk was selected, then an addiional prompt is provided:

Drive: \Path \ Filename

This allows the user to specify which drive and under what directory and file name label the data is sent to.
An understanding of DOS would help the user to make use of this facility.

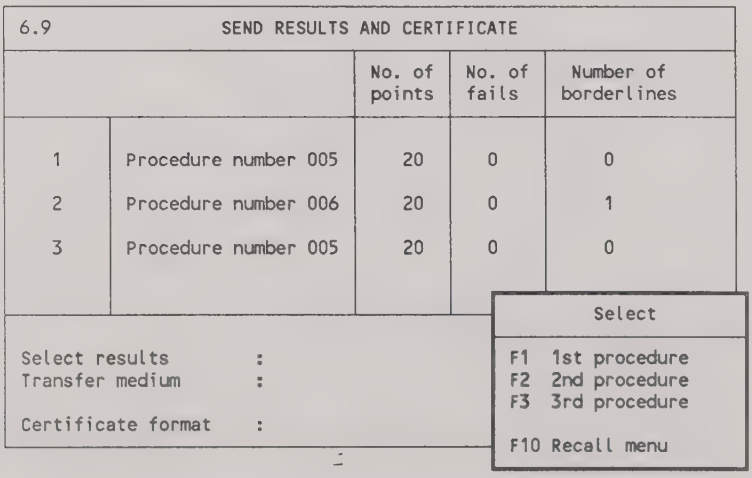


Fig 7.17 Recall Results - Send Results and Certificate Menu

Enter: A: for the floppy disk drive, or
C: for the hard disk.

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the results to the C drive (the hard disk) into a file called ABC.1$$ held in a subdirectory called XYZ. Note that the file extension (1$$) is fixed and may not be changed.

C:\ABC will transfer the results to the C drive into a file called ABC.1$$ under the main (root) directory.

A:\ABC will transfer the results to the root directory of the floppy disk (drive A) under a file name of ABC.1$$

ABC will copy the results to the default drive (drive C - hard disk), under the existing directory (PORTOCAL), with a file name of ABC.1$$

XYZ\ABC will copy the results to the default drive (drive C - hard disk), under a sub-directory XYZ beneath the PORTOCAL directory, in a file named ABC.1$$

The ASCII file produced is a sequential file, in exactly the same format as the normally printed calibration certificate, including all dividing lines, titles, spaces and text. The program CERTLOOK.BAS (described in paragraph 7.4.4) may be used to examine and print such files.

The 4101B software does not check for the validity if the entered Drive:\path\filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, and force the Recall Results menu (Fig 7.11), and abort the requested transfer.

7.4.3.2.2. Send to RS-232

If function key F2 is selected, then the system prepares to send the results via the RS-232C communications port to a peripheral or another computer. The results are transferred as ASCII codes in the form of the selected certificate design which may then be receiverd and manipulated by a user generated program.

The program COMM-IN.BAS (refer to paragraph 7.4.4) is supplied to assist with the generation of a program to perform this task, while the System Manager - System Configuration - Communication Port Setup menu (section 3, paragraph 3.2.3.17) allows the user to define the RS-232 communications port setups.

7.4.3.2.3 Certificate Format

After the transfer medium and Drive: \ Path \ Filename (if appropriate) have been specified, the next prompt - Certificate Format - provides the facility to define what type of certificate should accompany the results:

F1 Title Page only.
F2 Results only (a set of results in a compressed format, similar to 'Real Time Print').
F3 Full Certificate (the full set of results including the Title page).

Once the desired format has been selected, F4 (Send Certificate) will cause the transfer process to begin.

It does not matter when sending results via the RS-232C interface whether the receiver is activated before the sender or vice versa. The Portocal system will wait until they are both ready before transmission occurs.

Selection of F6 during the transmit process will abort the transfer and return control to the Recall Results menu (RS-232 transfers) or to the Send Results and Certificate menu (transfers to disk).

7.4.3.3 Send Results

Selection of function key F7 (Send Results) will display the Send Results Menu (Fig 7.18), where a summary of up to three sets of results which may have been chained together at the time of calibration will be displayed.

i) Select Procedure Number: Against this prompt the user selects which set of results are to be sent by selecting the appropriate function key.

ii) Transfer Medium: This may either be to hard or floppy disk or to the RS-232C interface port, by making the appropriate Drive: \Path \Filename entry. (Refer to paragraph 7.4.3.2).

Once transfer medium has been defined, selection of F4 (Send Results) will cause the results to be transferred as simple ASCII codes, either to the RS-232C port or a disk file, which may then be manipulated by user generated programs. The ASCII file generated is a sequential file, the layout of which is shown in Table 7.1, situated at the rear of this section. The basic programs RESLOOK.BAS and RESOLOOK.BAS (see paragraph 7.4.4) may be used to examine and print the files produced. If the transfer medium chosen was RS-232C, the results are transferred as ASCII codes. The program COMM-IN.BAS (see paragraph 7.4.4) is supplied to assist with the generation of a program to perform this task.

When Results (without certificate) are transferred to disk, the sytem automatically appends a file extension of 2$$ to the file name (i.e. file name RES would be transferred as RES.2$$). Consequently, extended file naming by the user, e.g. ABC.123, is not permitted. However, subdirectory names containing an extension (e.g. C:\RESULTS.TMP\ABC) are permitted.

The 4101B software does not check for the validity of the entered Drive:\path\filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, force the recall results menu (Fig 7.11), and abort the requested transfer.

At any point in the transmit process, selection of F6 will abort the transfer, and return control either to the Recall Results menu (RS-232 transfers) or to the Send Results menu (transfers to disk).

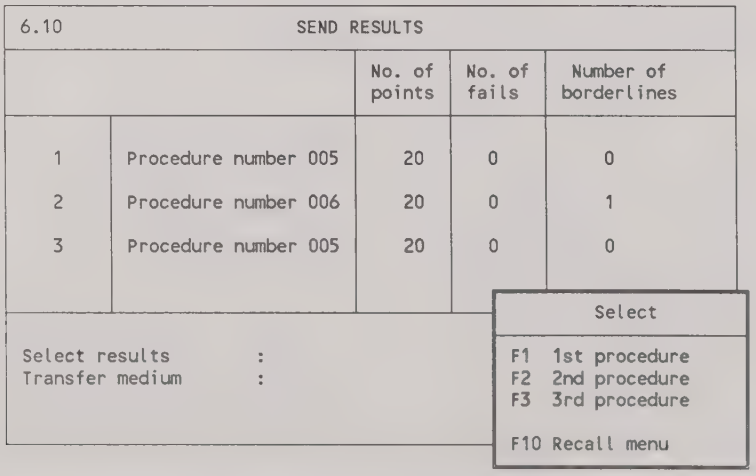


Fig 7.18 Recall Results - Send Results Menu

7.4.4 Starter Programs

Four BASIC programs have been provided under the PORTOCAL directory to help the user understand how to access results files which have been transferred to disk or via the RS 232C interface. These BASIC programs may be listed by the user to aid understanding of how to generate programs which can read and manipulate ASCII format results files. The four programs are designed to perform the following tasks:

i) The program RESLOOK.BAS will take a simple ASCII results file transferred by the Send Results function from disk and display with file entry descriptions on a screen or send to a printer.

ii) The program RESOLOOK.BAS will take a simple ASCII results file transferred by the Send Results function from disk and display without file entry descriptions on a screen or send to a printer.

iii) The program CERTLOOK.BAS will take an ASCII Results and Certificate file transferred by the Send Results and Certificate function from disk and display on a screen or send to printer.

iv) The program COMM-IN.BAS will receive an ASCII results file transferred by both the Send Results and Send Results and Certificate functions via the RS-232C communications interface and send it to screen, printer, or disk.

To utilise these programs, it will first be necessary to leave the Portocal environment and enter the Basic environment.

From the Portocal System menu (Fig 7.1), select F9 for the Portocal Exit menu (Fig 7.19), which will only be displayed if the system was specified as having no Park Disk command in the Manager - System Configuration menu (section 3, paragraph 3.2.3.11). Select F1 for Exit Portocal, and the C> prompt will be displayed.

Enter the Basic environment (for IBM-XT and COMPAQ II, type BASICA ↵ , for the HP Vectra, type GWBASIC ↵).

If the computer returns a message "Bad command or filename", this indicates that DOS was unable to find the program files required to enter the basic environment. It will be necessary to locate the relevant files, and inform DOS of their location on the hard disk.

C:\BASICA ↵ for the IBM-XT and Compaq II, if the file BASICA.COM is in the root directory.
C:\DOS\GWBASIC ↵ for the HP Vectra if the file GWBASIC.COM is in a subdirectory called DOS.

For more information on the basic environment for a specific computer, consult the basic manual supplied with the system.

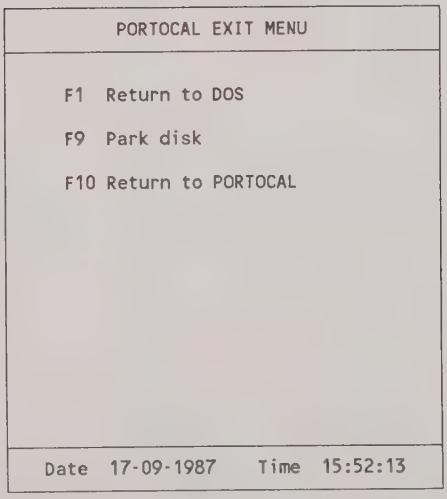


Fig 7.19 Portocal Exit Menu

7.4.4.1 RESLOOK.BAS

Once in the basic environment, type:

LOAD"RESLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

RESLOOK.BAS will look at results only files on a disk and display them on a screen or print them out, alongside descriptive labels. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .2$$.
Table 7.1 describes the file structure used by this type of results file.

7.4.4.2 RESOLOOK.BAS

Once in the basic environment, type:

LOAD"RESOLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

RESOLOOK.BAS will look at results files on a disk and display them on a screen or print them out without any descriptive labels. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .2$$.
Table 7.1 describes the file structure used by this type of results file.

7.4.4.3 CERTLOOK.BAS

Once in the basic environment, type:

LOAD"CERTLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

CERTLOOK.BAS will look at results files that were transferred to a disk by the Send Results and Certificate facility and display them on a screen or print them out in the form of a calibration certificate. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .1$$.
Once the file has been identified the program then gives the user the choice of displaying the results on the screen or printing them out.

7.4.4.4 COMM-IN.BAS

Once in the basic environment, type:

LOAD"COMM-IN.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

COMM-IN.BAS will receive data from the RS 232C interface and display, store to disk, or print out either the results or the results and certificate that have been transferred. The program will prompt the user to enter the details of the communications port set up.
It is important that these details exactly match the communications port set up of the sending Portocal system. Note that if the data is stored to disk the file name will automatically have an extension added (either 1$$ or 2$$) as described in Sections 7.4.3.2 and 7.4.3.3.

RECORD NUMBER	DATA	PARAGRAPH REF.
1	Instrument Serial Number	7.1.2.1
2	Instrument Code Number	7.1.2.2
3	Certificate Number	7.1.2.18
4	Instrument Manufacturer	7.1.2.4
5	Instrmment Type Number	7.1.2.5
6	Location	7.1.2.6
7	Customer	7.1.2.7
8	Procedure Number	7.1.2.9
9	Procedure Reference	9.9.3
10	Calibration Period	7.1.2.8
11	Calibration Date	(Date procedure run)
12	Calibration Due Date	(Records 10 + 11)
13	Result File Name	
14	Calibration Type	7.1.2.15
15	Temperature	7.1.2.11
16	Temperature Tolerance	7.1.2.11
17	Relative Humidity	7.1.2.12
18	Relative Humidity Tolerance	7.1.2.12
19	System Type	10.5.5
20	Calibrator 1 Type	10.5.5
21	Calibrator 1 Serial Number	S/N of Calibrator 1
22	Calibrator 2 Type (if any)	
23	Calibrator 2 Serial Number (if any)	S/N of Calibrator 2
24	Summary Comments Line 1	7.1.2.20, 7.4.2.1, 8.4
25	Summary Comments Line 2	
26	Summary Comments Line 3	
27	Summary Comments Line 4	
28	Total Number of Test Points	
29	Number of Test Points Failed	
30	Number of Borderline Test Points	
31	Procedure Aborted? (Yes/No)	
32	Number of Functions Tested	
33	Title of first Function tested	9.10.4
34	No. of Test Points in first Function	
35	Number of first Testpoint	
36	Range	
37	Range Scalar	
38	Applied Value	
39	Applied Value Scalar	
40	Applied Value Frequency (* if not AC)	
41	Applied Value Frequency Scalar	
42	Instrument Reading	
43	Instrument Reading Scalar	
44	Noisy Reading (Yes/No)	
45	High Limit Value	
46	High Limit Value Scalar	
47	Low Limit Value	
48	Low Limit Value Scalar	
49	Result of Test (Pass/Fail)	
50	Number of next Test Point	
etc.	etc.	

Repeat from field number 33 for the remaining functions.

Table 7.1 Layout of Transferred Results Only Files.

SECTION 8: THE RECALL RESULTS PROGRAM

8.0 Introduction

All results saved by the system when the Calibrate program is being run are stored on the system's hard disk. The Recall Results program allows an operator to:

i) Search through the results library and recall results that meet certain criteria.
ii) Temporarily change the format in which these results are displayed and printed.
iii) Modify any Extra Summary Comments that were inserted at run-time.
iv) Print out sets of results in the form of Calibration Certificates.
v) Review the results on the System Monitor.
vi) Send the results to either an ASCII file held on disk or over the RS-232 interface, either in a Calibration Certificate Format or in a compressed format.

The system maintains a Master Results Index which keeps track of all results, even if they have been archived to floppy disks by the System Manager Program, and will provide all the necessary prompts for the user to locate the results of interest.

8.1 Operation

Selecting Function key F2 (Recall Results Menu) on the Portocal System Menu (Fig 8.1) will display the Recall Results Menu (Fig 8.2).

The facilities available within this program are:

i) Select Results from Library (F1):
Before a set of results may be manipulated in any way, they must first be recalled from the results library into the temporary result file. The Select Results from Library facility allows the user to search for the sets of results of interest, and recall them from the results library.

ii) Change Current Certificate (F2):
All sets of results held on the system are stored with the original certificate type number used when the results were actually taken. Change Current Certificate allows the operator to change the type of certificate used when subsequently manipulating the results.

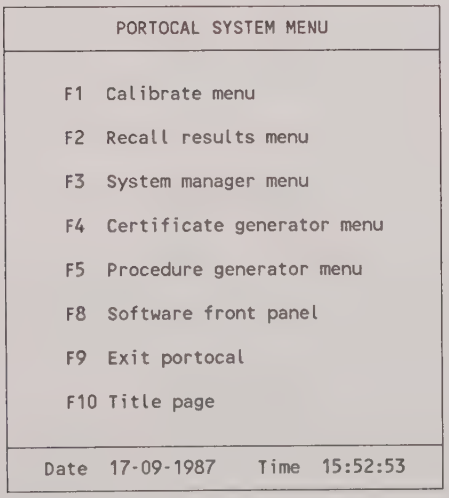


Fig 8.1 Portocal System Menu

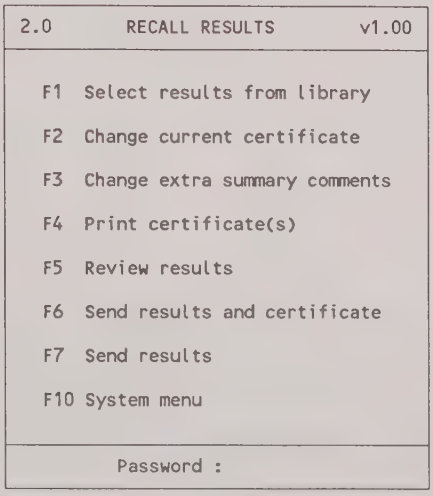


Fig 8.2 Recall Results Menu

iii) Change Extra Summary Comments (F3):
This facility allows the operator to amend or alter the Extra Summary Comments that were added to the results when they were taken using the Calibrate program. These changes will be saved into the results file that is stored in the results library, unless the results have previously been archived to floppy disk. Of all of the Recall Results programs, this is the only program that alters the data stored in the results database, rather than operating on the temporary results file.

iv) Print Certificate(s) (F4):
If a single set of results was selected from the Recall Results Library then Print Certificate will give a printout of these results.
If the results were recalled in batch mode (using the 'All' facility available in the Recall Results Library), then Print Certificates will print out all of the sets of results in a batch.
This batch print mode will not operate with sets of results previously archived onto floppy disk. Any results which fall within the parameters of a batch search but which have been previously archived will be ignored. - i.e. - All results for a batch print must still be located on the system hard disk.

v) Review Results (F5):
If a single set of results has been selected from the Recall Results Library, then Review Results will allow these results to be viewed on the monitor screen.

vi) Send Results and Certificate (F6):
In order to save space on the system hard disk, all results are stored in a compacted form. Send Results and Certificate is a facility which will convert selected results files into easy-to-access ASCII files which may then be transferred to user - named files on a floppy disk or an area of the hard disk. These ASCII files will be presented in the form of a calibration certificate, and can be readily manipulated by a user-generated program in order to create a totally customized print format (for example). Send Results and Certificate can also transfer these ASCII files via the system RS 232C port to peripheral or another computer for processing.

vii) Send Results (F7):
This facility is identical to the Send Results and Certificate, except that the data transferred is not presented inside the certificate format. The layout of the transferred file is shown in table 7.1, situated at the rear of section 7

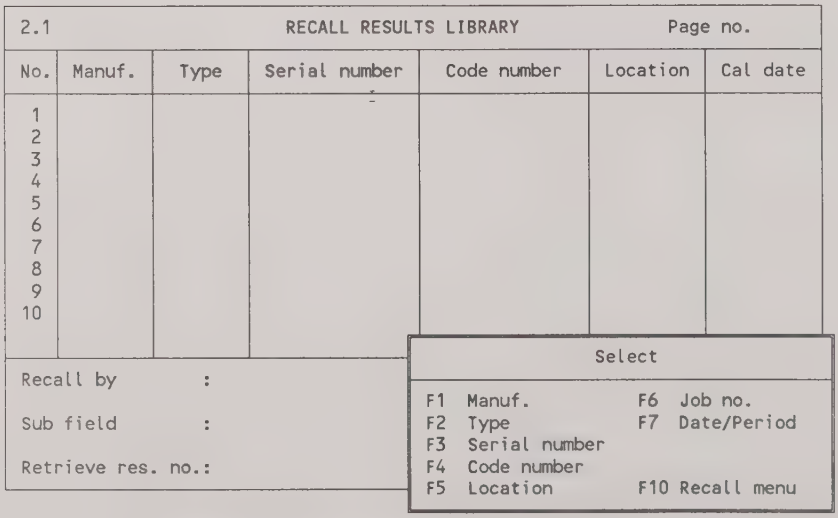


Fig 8.3 Recall Results Library Menu

8.2 Recall Results Library

8.2.1 Operation

Before a set of calibration results may be recalled, the system must be informed of the results to be recalled. A search through the Instrument database and the Results library must be initiated by the user, and then a set or sets of results must be identified for recall.

Selecting function key F1 (Select Results from Library) from the Recall Results Menu (Fig. 8.2) will display the Recall Results Library (Fig 8.3). The top part of this page is an area where multiple pages, each showing up to ten sets of details, can be displayed. These details are concerned with sets of results which have been found using the search facilities shown in the select window at the bottom of the Recall Results Library Menu.

8.2.2 Search Facilities.

These search facilities allow a set of calibration results to be recalled by up to two of the following parameters:

i) Manufacturer
ii) Instrument Type
iii) Instrument Serial Number
iv) Instrument Code Number
v) Location
vi) Job Number
vii) The Date and Period during which the calibration was performed.

8.2.3 Define Search Parameters.

With the highlighted cursor over the "Recall By" field, select the required primary search parameter from the available selections shown in the select window. When the parameter is entered correctly, press the ↵ key to enter that parameter.
The highlighted cursor will now step to the next field, the contents of which will be determined by the parameter selected. Enter the primary search parameter required, followed by the ↵ key.
The highlighted cursor will move to the next field, called Sub Field.
Select the secondary search parameter from the available selections shown in the select window, and press the ↵ key when correct. The highlighted cursor will move to the next field, the contents of which will be determined by the parameter selected.

Some examples of the parameters available and the subsequent search performed by the system are shown below.

Primary Field: Manufacturer
DATRON
Secondary Field: Type Number
1061A
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to Datron 1061A's

Primary Field: Serial Number
10904
Secondary Field: Date / Period
01-01-86 For 365 Days.
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to the instrument with serial number 10904 that were taken during 1986.

There are two points worth noting:

i) The search routines differentiate between upper and lower case characters. For instance, searches by DATRON, Datron and datron are different.

ii) A wild card character, * is available, for example:

Primary Field: Customer
TEST*
(No secondary field specified)
The search will result in a line of information being displayed on the system monitor for all of the calibration results taken on instruments belonging to all customers beginning with TEST, for example TEST ENGINEERING, TEST BAY, TEST SYSTEM 1 etc.

8.2.3.1 Notes on "Universal Titles"

The titles of all of the available search parameters, with the exception of Date/Period, may be edited using the System Manager - Universal Titles facility (refer to section 11, paragraph 11.9).

8.2.4 Perform Search.

When the search field or fields are correctly entered, select the F9 key to initiate the search. The system will locate those results that match the search criteria entered, and display one line of information on the screen for each of the results found. If there are more than ten sets of results found that match the search criteria, then the select window will display a choice of "Page Library". Selection of the F9 key will update the display with the next ten sets of results, and the page number displayed in the top right hand corner of the screen will be incremented. If there are more results fitting the selection criteria, the selection of the F9 key will page the library further, until all of the results have been presented. At this point, the function of the F9 key reverts to "Perform Search".

8.2.5 Previously Archived Results

Any details displayed on the screen after a search which show an asterisk (*) against the Cal date will be associated with results which have been removed from the hard disk and archived onto a volume of floppy disk. If such results are selected for recall (see below) then the system will inform the user which archive volume should be inserted into the floppy disk drive in order to recall them.

8.2.6 Retrieve Result No.

8.2.6.1 Retrieve Multiple Sets of Results.

Once the search has been performed, with the highlighted cursor over the Retrieve Res. No. field, the select window will display a selection F1 All. This selection specifies the recall of all of the calibration results, in a batch, that meet the search criteria entered earlier. If a set of calibration results is recalled in this batch mode, then the only actions that may be performed on these results are:

a) Printout of a set of calibration certificates.
b) Change Certificate format.

8.2.6.1.1 Creating the Batch File.

With the Retrieve Res. No. field as All, press the ↵ key. The select window will now give the choice of selecting F8 for Retrieve Res. If F8 is selected, the system will respond with the message "Creating Batch File" and the details corresponding to each of the results will appear on the screen as each result is recalled.
Note, however, that if any previously archived results are included in the results to be recalled, they will not be recalled, and will be ignored.

8.2.6.1.2 Chained Procedures.

When all of the results have been recalled, the system will prompt "For chained procedures select 'ALL' or 'LAST' set of results", and the select window will display F1 for ALL and F2 for LAST. This prompt is significant if any of the calibration results selected for recall were taken using multiple procedures that were chained together (refer to section 7, paragraph 7.1.2.10). The selection of 'ALL' will cause the retrieval of all of the results taken, while 'LAST' initiates the retrieval of the results of only the last procedure run.

8.2.6.1.3 Type of Certificate.

A choice will then be offered as to the type of printout required:

F1 Title Pages only.
F2 Results only (sets of results in a compressed format, similar to 'Real Time Print')
F3 Full certificates (the full sets of results including the Title page).

Select the required Certificate Format using the relevant function key and when the recall operation is complete, the software will return to the Recall Results menu, Fig 8.2.

8.2.6.2 Retrieve a Single Set of Results.

To have access to the other Recall Results facilities, such as
a) Change Extra Summary Comments,
b) Review Results,
c) Send Results and Certificate,
d) Send Results,
the set of results of interest must be recalled in isolation to all other results.

Once the search has been performed, with the highlighted cursor over the Retrieve Res. No. field, type the number corresponding to the set of results required, which is displayed on the left hand side of the screen and press the ↵ key. When the F8 key (Retrieve Res.) is pressed, the system will then read that set of results into the temporary file.

If, however, the results to be retrieved have previously been archived to floppy disk, the user is prompted to insert the necessary Archive Volume.

In either case, the system will return a message "Retrieving results", and when completed, will return to the Recall Results menu, Fig 8.2.

8.3 Change Current Certificate.

When a set (or sets) of results have been recalled from the Results Library the Recall Certificate Library Menu will permit the type of certificate originally used for printout of this particular set of results to be altered for the printout to be carried out now.
This change will only be active while the results of interest are held in the temporary file, i.e. if the same set of results are recalled again, the certificate format will revert to that used when the results were taken.

8.3.1 Operation

Selecting function key F2 (Change Current Certificate) from the Recall Results Menu (Fig 8.2) will cause a cursor to flash against the Password prompt. Correct entry of the Calibrate Password will display the Recall Results - Certificate Library Menu (Fig 8.4). This will list the certificate types available. Entry of a Certificate Type Number will cause the subsequent review or printout of the set (or sets) of results to be in the format of that particular certificate type.
Enter the desired Certificate Type, followed by the ↵ key, and select Function key F10 (Recall Results) to exit to the Recall Results Menu (fig 8.2).

8.4 Change Extra Summary Comments

This facility allows the Extra Summary Comments attached to any sets of results still held in the results library on the hard disk to be permanently altered or added to. This facility is only offered for Results which have been selected singly (i.e. not a batch) from the Results Library, and furthermore are still physically held on hard disk.
In the case of results that have been previously archived, any changes made to the Extra Summary Comments are only made to the temporary results file: the results held on the floppy disk are left unaltered.

8.4.1 Operation

Selection of function key F3 (Change Extra Summary Comments) from the Recall Results Menu (Fig 8.2) will cause a cursor to flash against the Password prompt. Correct entry of the Calibrate password will display the Change Extra Summary Comments Menu (Fig 8.5).

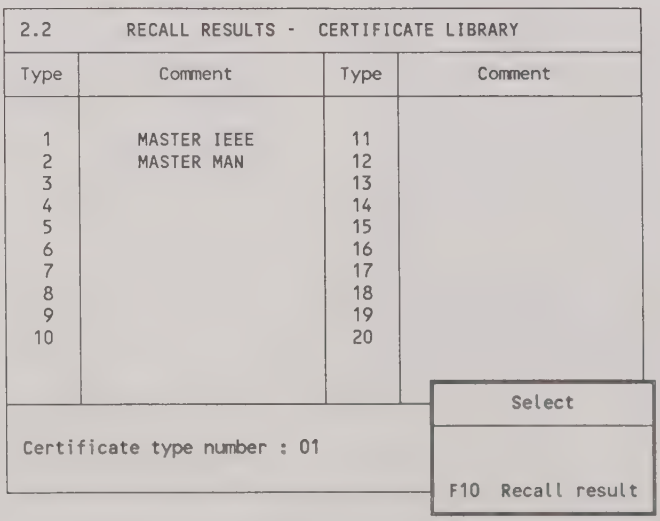


Fig 8.4 Recall Results - Certificate Library Menu

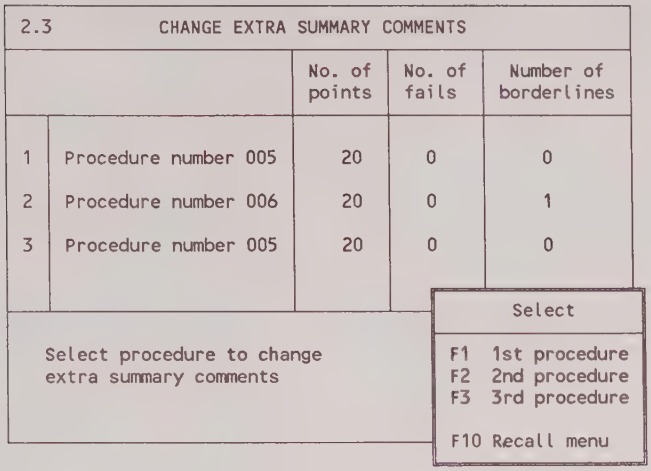

2.3 CHANGE EXTRA SUMMARY COMMENTS
No. of points
No. of fails
Number of borderlines
1 Procedure number 005 20 0 0
2 Procedure number 006 20 0 1
3 Procedure number 005 20 0 0
Select procedure to change extra summary comments
Select
F1 1st procedure
F2 2nd procedure
F3 3rd procedure
F10 Recall menu

Fig 8.5 Change Extra Summary Comments Menu

This menu will list up to three subsets of results held within the selected results file. More than one subset is caused when more than one procedure is chained together using the Calibrate program (refer to section 7, paragraph 7.1.2.10). A summary of the numbers of testpoints, fails and borderline passes for any particular subset of results is also shown on this menu.

Selection of the appropriate function key from the Select Box will display the Recall Results - Extra Summary Comments Menu (Fig 8.6) where any alterations may be made.

8.4.2 Editing Extra Summary Comments

On entry to the Recall Results - Extra Summary Comments menu (Fig 8.6) the Extra Summary Comments associated with the selected subset of results will be displayed. This text may now be amended using full cursor control, upper and lower case characters, and the facilities of Clear Entry, Initialise Entry, Insert Line and Delete Line available from the Select Window. In addition, there are several "hidden" function keys that allow other editing facilities, as described in section 5, paragraph 5.2.

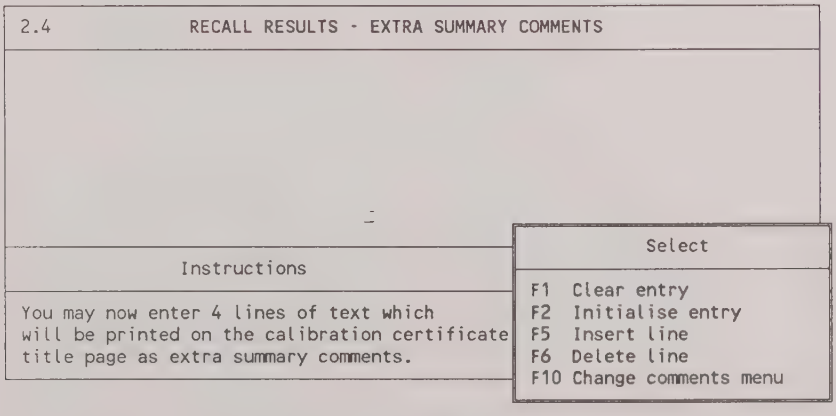

2.4 RECALL RESULTS - EXTRA SUMMARY COMMENTS
Instructions
You may now enter 4 lines of text which will be printed on the calibration certificate title page as extra summary comments.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Change comments menu

Fig 8.6 Recall Results - Summary Comments Menu

The only one of these facilities which is not obvious is Initialise Entry which allows the user to recall the text stored with the results prior to recall from the results library.

Selection of function key F10 (Change Comments Menu) will overwrite the original Extra Summary Comments on the hard disk with the new text. In the case of previously archived results, only the comments in the temporary results files are changed. When the saving process is complete, the Change Extra Summary Comments Menu. (Fig 8.5) will be displayed.

Further selection of function key F10 will return the Recall Results Menu (Fig 8.2) to the display.

8.5 Print Certificate(s)

If a "batch" of results has been recalled, then the printing will commence immediately the F4 key is selected from the Recall Results Menu (Fig 8.2).

If, however, a single set of results has been recalled, selection of function key F4 (Print Certificate) from the Recall Results Menu (Fig 8.2) will display the Print Certificate Menu (Fig 8.7) which will list a summary of up to 3 procedures which may have been chained together.

Function keys F1, F2, and F3 allow the selection of the first, second and third procedures run, respectively, while F4 allows the selection of the results from all of the procedures run, if applicable.

The prompt "How many copies" will appear. Enter the number of copies required, followed by the ↵ key.

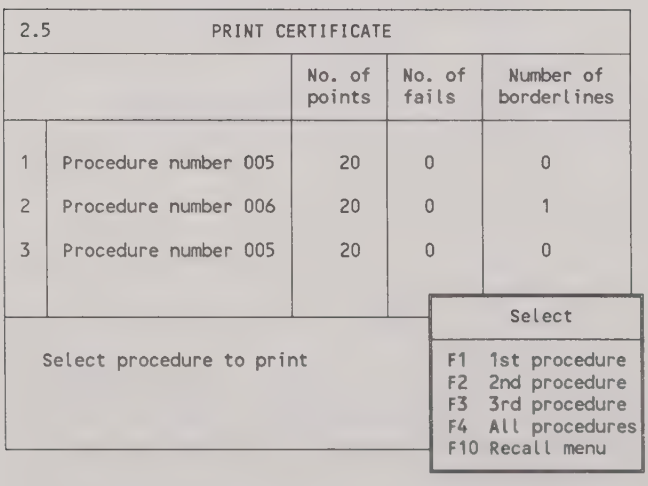


Fig 8.7 Print Certificate Menu

A choice will then be offered as to the type of printout required:

F1 Title Page only.
F2 Results only (a set of results in a compressed format, similar to 'Real Time Print').
F3 Full Certificate (the full set of results including the Title page).

Select the required printout format using the relevant function key and the printout will begin. If at any time, it is wished that the printout be suspended, the function key F6 will abort the printout and command the printer to perform a page eject.

When the printer has finished, selection of function key F10 (Recall Menu) will display the Recall Results Menu (Fig 8.2)

8.6 Review Results

Selection of the F5 key (Review Results) from the Recall Results Menu (Fig 8.2) will display the Results Summary (Fig 8.8), where up to 3 procedures which may have to be chained together are listed. This summary also indicates how many testpoints, borderline passes and failures occurred for each procedure. Note that this selection is not available if the current results have been recalled in "Batch" mode.

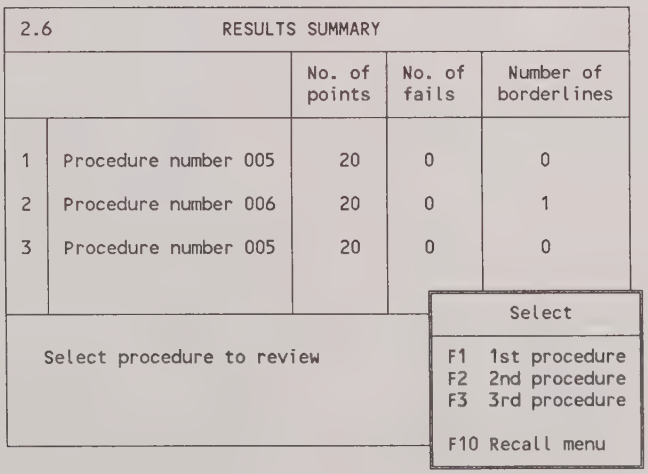


Fig 8.8 Results Summary Menu

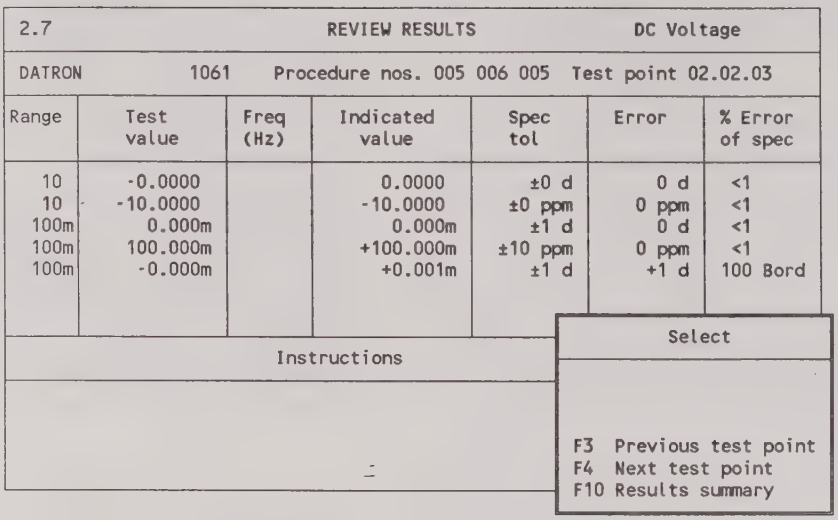

2.7
REVIEW RESULTS
DC Voltage
DATRON 1061 Procedure nos. 005 006 005 Test point 02.02.03
Range
Test value
Freq (Hz)
Indicated value
Spec tol
Error
% Error of spec
10 -0.0000 0.0000 ±0 d 0 d <1
10 -10.0000 -10.0000 ±0 ppm 0 ppm <1
100m 0.000m 0.000m ±1 d 0 d <1
100m 100.000m +100.000m ±10 ppm 0 ppm <1
100m -0.000m +0.001m ±1 d +1 d 100 Bord
Instructions
Select
F3 Previous test point
F4 Next test point
F10 Results summary

Fig 8.9 Review Results Menu

Choosing the function key (F1, F2 or F3) associated with the procedure whose results are to be viewed will display the Review Results Menu (Fig 8.9).

In the Review Results Menu, Fig 8.9, up to five lines of results are shown at any one time. Function keys F1 to F4 allow the testpoints of interest to be displayed.

Selection of function key F10 (Results Summary Menu) will return the Results Summary Menu (Fig 8.13) to the screen. Further selection of function key F10 (Recall Menu) will display the Recall Results Menu (Fig 8.2).

8.7 Results Transfer

8.7.1 Introduction

The Portocal system normally stores results in a compressed format on the controller's hard disk. This has the advantage of saving space on the disk, but prevents the user from investigating and manipulating the results files using his own programs. The 'Send Results' and 'Send Results and Certificate' facilities allow the user to transfer results in one of several different ways:

i) As a simple ASCII file on floppy disk.
ii) As an ASCII file based on a complete certificate design on floppy disk.
iii) As (i) and (ii) but as files on the hard disk.
iv) As (i) and (ii) but transferred to another computer via the RS-232C communications interface.

Note that this method of results transfer does not permit results taken from one Portocal system to be loaded into the results files of another Portocal system. The purpose of these facilities is to allow the user to generate programs which can manipulate results files in ASCII format to provide such facilities as totally customized print formats, for example.

8.7.2 Send Results & Certificate

Selection of function key F6 (Send Results & Certificate) will display the Send Results & Certificate Menu (Fig 8.10), where a summary of up to three sets of results which may have been chained together at the time of calibration will be displayed.

i) Select Procedure Number: Against this prompt the user selects which set of results are to be sent by selecting the appropriate function key.

ii) Transfer Medium: The select box offers the choice of transferring the results of the calibration to hard or floppy disk (function key F1), or to the RS-232C communications port (function key F2).

8.7.2.1 Send to Disk

If transfer to disk was selected, then an addiional prompt is provided:

Drive: \Path \ Filename

This allows the user to specify which drive and under what directory and file name labels the data is sent to.

An understanding of DOS would help the user to make use of this facility.

Enter: A: for the floppy disk drive, or
C: for the hard disk.

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the results to the C drive (the hard disk) into a file called ABC.1$$ held in a subdirectory called XYZ. Note that the file extension (1$$) is fixed and may not be changed.

C:\ABC will transfer the results to the C drive into a file called ABC.1$$ under the main (root) directory.

A:\ABC will transfer the results to the root directory of the floppy disk (drive A) under a file name of ABC.1$$

ABC will copy the results to the default drive (drive C - hard disk), under the existing directory (PORTOCAL), with a file name of ABC.1$$

XYZ\ABC will copy the results to the default drive (drive C - hard disk), under a subdirectory XYZ beneath the PORTOCAL directory, in a file named ABC.1$$

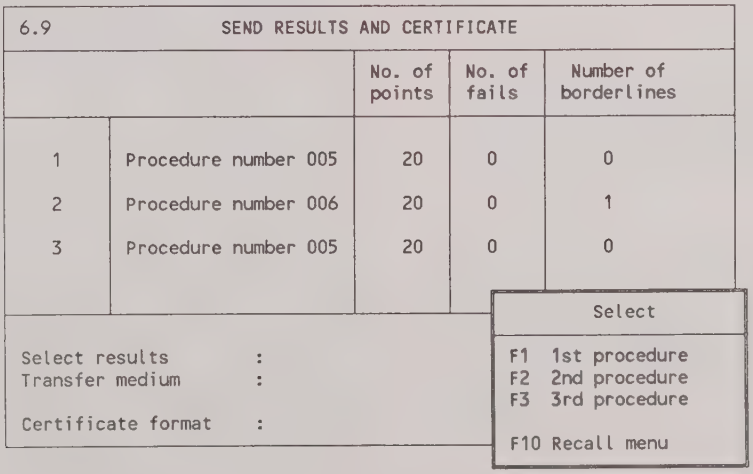


Fig 8.10 Send Results and Certificate Menu

The ASCII file produced is a sequential file, in exactly the same format as the normally printed calibration certificate, including all dividing lines, titles, spaces and text. The program CERTLOOK.BAS (described in paragraph 8.9.3) may be used to examine and print such files.

The 4101B software does not check for the validity of the entered Drive: \ Path \ Filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, abort the requested transfer and force the Recall Results menu (Fig 8.2).

8.7.2.2. Send to RS-232

If, at the Transfer Medium prompt, function key F2 is selected, then the system prepares to send the results via the RS-232C communications port to a peripheral or another computer. The results are transferred as ASCII codes in the form of the selected certificate design which may then be manipulated by a user generated program.

The program COMM-IN.BAS (refer to paragraph 8.9.4) is supplied to assist with the generation of a program to perform this task, while the System Manager - System Configuration - Communication Port Setup menu (section 3, paragraph 3.2.3.17) allows the user to define the RS-232 communications port setups.

8.7.2.3 Certificate Format

After the transfer medium and path and file name (if appropriate) have been specified, the next prompt - Certificate Format - provides the facility to define what type of certificate should accompany the results:

F1 Title Page only.
F2 Results only (a set of results in a compressed format, similar to 'Real TimePrint').
F3 Full Certificate (the full set of results including the Title page).

Once the desired format has been selected, F4 (Send Certificate) will cause the transfer process to begin.

It does not matter when sending results via the RS-232C interface whether the receiver is activated before the sender or vice versa. The Portocal system will wait until they are both ready before transmission occurs.

Selection of F6 during the transmit process will abort the transfer and return control to the Recall Results menu (RS-232 transfers) or to the Send Results and Certificate menu (transfers to disk).

8.7.3 Send Results

Selection of function key F7 (Send Results) will display the Send Results Menu (Fig 8.11), where a summary of up to three sets of results which may have been chained together at the time of calibration will be displayed.

i) Select Procedure Number: Against this prompt the user selects which set of results are to be sent by selecting the appropriate function key.

ii) Transfer Medium: This may either be to hard or floppy disk or to the RS-232C interface port, by making the appropriate Drive: \ Path \ Filename entry. (Refer to paragraph 8.8.2.1).

Once transfer medium has been defined, selection of F4 (Send Results) will cause the results to be transferred as simple ASCII codes, either to the RS-232C port or a disk file, which may then be manipulated by user generated programs. The ASCII file generated is a sequential file, the layout of which is shown in Table 7.1, situated at the end of section 7. The basic programs RESLOOK.BAS and RESOLOOK.BAS (refer to paragraphs 8.9.1 and 8.9.2) may be used to examine and print the files produced. If the transfer medium chosen was RS-232C, the results are transferred as ASCII codes. The program COMM-IN.BAS (refer to paragraph 8.9.4) is supplied to assist with the generation of a program to perform this task.

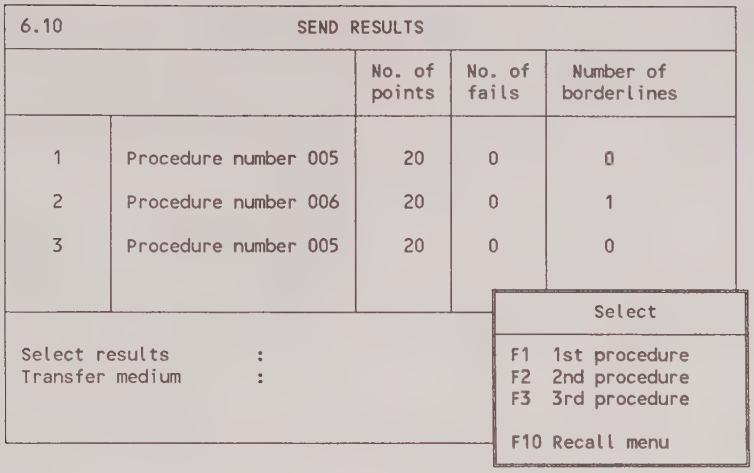


Fig 8.11 Send Results Menu

Note: When Results (without certificate) are transferred to disk, the sytem automatically appends a file extension of 2$$ to the file name (i.e. file name RES would be transferred as RES.2$$). Consequently, extended file naming by the user, e.g. ABC.123, is not permitted. However, subdirectory names containing an extension (e.g. C:\RESULTS.TMP\ABC) are permitted.

The 4101B software does not check for the validity of the entered Drive:\Path\Filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, abort the requested transfer and force the recall results menu (Fig 8.2).

At any point in the transmit process, selection of F6 will abort the transfer, and return control either to the Recall Results menu (RS-232 transfers) or to the Send Results menu (transfers to disk).

8.8 Starter Programs

Four BASIC programs have been provided under the PORTOCAL directory to help the user understand how to access results files which have been transferred to disk or via the RS 232C interface. These BASIC programs may be listed by the user to aid understanding of how to generate programs which can read and manipulate ASCII format results files. The four programs are designed to perform the following tasks:

i) The program RESLOOK.BAS will take a simple ASCII results file transferred by the Send Results function from disk and display with file entry descriptions on a screen or send to a printer.

ii) The program RESOLOOK.BAS will take a simple ASCII results file transferred by the Send Results function from disk and display without file entry descriptions on a screen or send to a printer.

iii) The program CERTLOOK.BAS will take an ASCII Results and Certificate file transferred by the Send Results and Certificate function from disk and display on a screen or send to printer.

iv) The program COMM-IN.BAS will receive an ASCII results file transferred by both the Send Results and Send Results and Certificate functions via the RS-232C communications interface and send it to screen, printer, or disk.

To utilize these programs, it will first be necessary to leave the Portocal environment and enter the Basic environment.

From the Portocal System menu (Fig 8.12), select F9 for the Portocal Exit menu (Fig 8.13), which will only be displayed if the system was specified as having a Park Disk command in the Manager - System Configuration menu (section 3, paragraph 3.2.3.11). Select F1 for Exit Portocal, and the C> prompt will be displayed.

Enter the Basic environment (for IBM-XT and COMPAQ II, type BASICA ↵ , for the HP Vectra, type GWBASIC ↵).

If the computer returns a message "Bad command or filename", this indicates that DOS was unable to find the program files required to enter the basic environment. It will be necessary to locate the relevant files, and inform DOS of their location on the hard disk.

C:\BASICA ↵ for the IBM-XT and Compaq II, if the file BASICA.COM is in the root directory.
C:\DOS\GWBASIC ↵ for the HP Vectra if the file GWBASIC.COM is in a subdirectory called DOS.

For more information on the basic environment for a specific computer, consult the basic manual supplied with the system.

8.8.1 RESLOOK.BAS

Once in the basic environment, type:

LOAD"RESLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

RESLOOK.BAS will look at results only files on a disk and display them on a screen or print them out, alongside descriptive labels. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .2$$. Table 7.1, situated at the end of section 7, describes the file structure used by this type of results file.

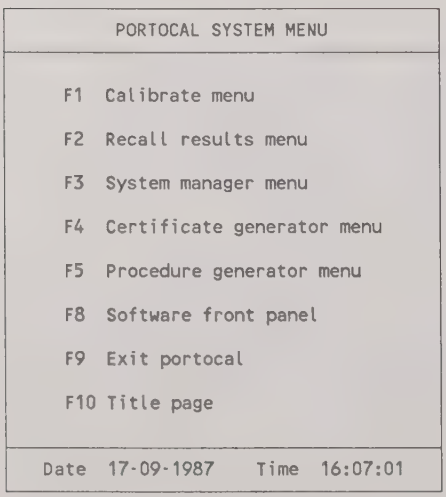


Fig 8.12 Portocal System Menu

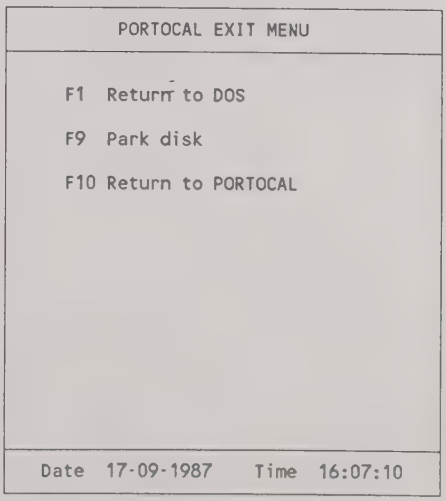


Fig 8.13 Portocal Exit Menu

8.8.2 RESOLOOK.BAS

Once in the basic environment, type:

LOAD"RESOLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

RESOLOOK.BAS will look at results only files on a disk and display them on a screen or print them out without any descriptive labels. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .2$$.
Table 7.1, situated at the end of section 7, describes the file structure used by this type of results file.

8.8.3 CERTLOOK.BAS

Once in the basic environment, type:

LOAD"CERTLOOK.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

CERTLOOK.BAS will look at results files that were transferred to a disk by the Send Results and Certificate facility and display them on a screen or print them out in the form of a calibration certificate. The program will prompt the user to enter the drive, path and file name so that the the correct results file can be located.
Note that this type of result file is transferred by the 4101B software with an extension of .1$$.
Once the file has been identified the program then gives the user the choice of displaying the results on the screen or printing them out.

8.8.4 COMM-IN.BAS

Once in the basic environment, type:

LOAD"COMM-IN.BAS" ↵

At the 'Ok' prompt, select F2 to RUN the program.

COMM-IN.BAS will receive data from the RS 232C interface and display, store to disk, or print out either the results or the results and certificate that have been transferred. The program will prompt the user to enter the details of the communications port set up.
It is important that these details exactly match the communications port set up of the sending Portocal system. Note that if the data is stored to disk the file name will automatically have an extension added (either 1$$ or 2$$) as described in Sections 8.7.2.1 and 8.7.3.

SECTION 9: THE PROCEDURE GENERATOR

9.1 Introduction.

The procedure generator is used to develop and edit calibration procedures for almost any type of multimeter. Once procedures have been tested, approved and saved on disk they can be repeatedly run using the Calibrate program. The system can store up to 999 procedures.

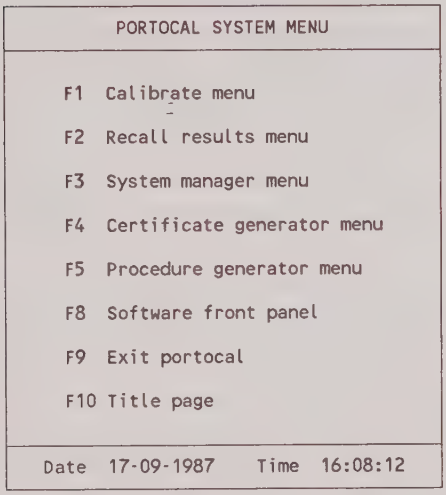


Fig 9.1 Portocal System Menu

9.2 Operation

From the Portocal System Menu (Fig 9.1), select function key F5 (Procedure Generator) to display the Procedure Generator Menu.(Fig 9.2) This menu provides a description of the current procedure held in a temporary file (see paragraph 9.3, below) and also lists all the facilities available with this section of the program.

9.3 Temporary File

Before a calibration procedure can be edited, reviewed or printed, it must first be recalled from the procedure library and placed in a "temporary" procedure file, otherwise referred to as procedure number 000. Any changes made to this procedure are written to disk, but will not be written into the original copy of the procedure located in the procedure library, until the Save Procedure command is issued.

The top area of the Procedure Generator Menu identifies what is currently being held in the temporary file by the 'Current procedure number', the instrument 'Description' and the procedure 'Comments'.

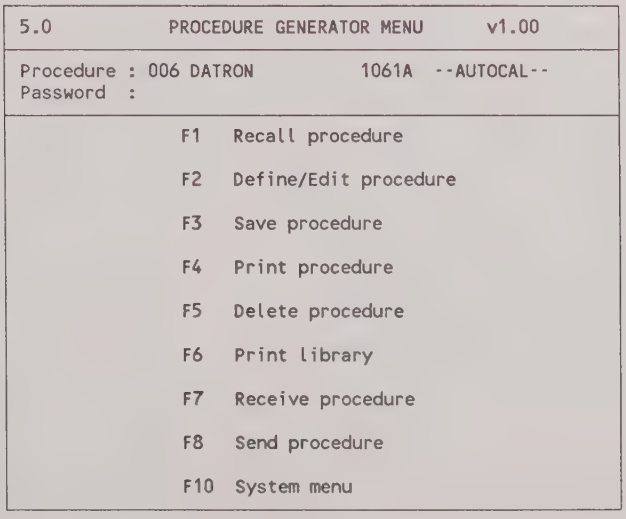


Fig 9.2 Procedure Generator Menu

The 'Current procedure number' will be zero when defining a totally new procedure. Otherwise, it will give the number of the last procedure to be recalled.

'Description' identifies the manufacturer and model number of the instrument which the current procedure in the temporary file is dealing with. If 'Description' is blank, then the temporary file is empty.

If the procedure has been recalled, then the 'Comments' line gives the description which was attached to the procedure when it was last saved into the procedure library.

9.3.1 Renumbering and Repositioning of Procedures

Procedures can be renumbered with a simple recall, save and delete process. For example, procedure number 2 could be recalled, using the Recall Procedure Menu (paragraph 9.5). It could then be resaved as procedure 865 using the Save Procedure Menu (paragraph 9.6), and then the original procedure 2 could be deleted from the library, using the Delete Procedure Menu (paragraph 9.7). This kind of process allows the user to partition procedures and, for example, can be used to allocate complete pages of procedures to specific manufacturers, to aid recall.

However, it is important to understand the implications of performing this process. The calibration results files hold only the measured value, a pass/fail/borderline flag and a noisy reading flag. In order to reconstruct recalled results, the applied value and relevant specifications are extracted from the calibration procedure that was used to obtain those results. Consequently, if the position of a procedure in the library has been changed, by using this recall - save - delete process, it may cause a set of previously obtained results to be unavailable or non-sensical.

9.4 General Facilities.

From the Procedure Generator Menu (Fig 9.2), the function keys F1 to F8 gives access to the major facilities available with the Procedure Generator.

F1 Recall Procedure permits the operator to view the locations of all existing procedures, and select the recall of any of the existing procedures into the temporary procedure file, procedure number 000.

F2 Define/Edit Procedure is the main development tool of the program, enabling the user to generate procedures for calibration of any type of multimeter. If an existing procedure has been previously recalled into the temporary file, then Define/Edit procedure can also be used to edit that procedure, in order to correct it or to create a similar procedure which may later be saved on disk.

F3 Save Procedure takes the details of the current procedure held in temporary file and writes them into the procedure library.

F4 Print Procedure will give a print-out of all the parameters associated with that procedure.

F5 Delete Procedure can be used to erase an obsolete procedure from the disk.

F6 Print Library enables a list of all the procedures currently held in the procedure library to be printed.

F7 Recieve Procedure enables the direct reading from either a procedure file held on the hard disk, a floppy disk or the RS-232 interface into the procedure library.

F8 Send Procedure enables the writing of a procedure from the Procedure Library into a file on the hard or floppy disk or the sending of a procedure from the Procedure Library to another Portocal system, over the RS-232 interface.

9.5 Recall Procedure

9.5.1 Introduction

As mentioned previously, before an existing procedure may be modified, a copy of that procedure must be 'recalled' into the temporary file.

9.5.2 Operation

Selecting function key F1 (Recall Procedure) on the Procedure Generator menu (Fig 9.2) calls up the Recall Procedure menu (Fig 9.3). This will show the first page of the library, displaying the descriptions and comments applicable to the first 20 of 999 procedures.

The library of procedures can be stepped through using the function keys F1 and F2 as shown in the Select Box. F1 (Next page), will result in the display being updated with the descriptions and comments applicable to the next 20 procedures in the library. F2 (Page select) allows the operator to select a page start number (e.g. 856), followed by the ↵ key, and will display a page of 20 procedures with numbers sequentially following on from the page start number, 856-876.

To recall a procedure, merely type in the procedure number of the required selection, followed by the key and select function key F3 to initiate the recall process. When the recall process is under way, the screen will display a message "Recalling procedure XXX", and when it has finished recalling procedure XXX, the message "Procedure recalled successfully" will be displayed.

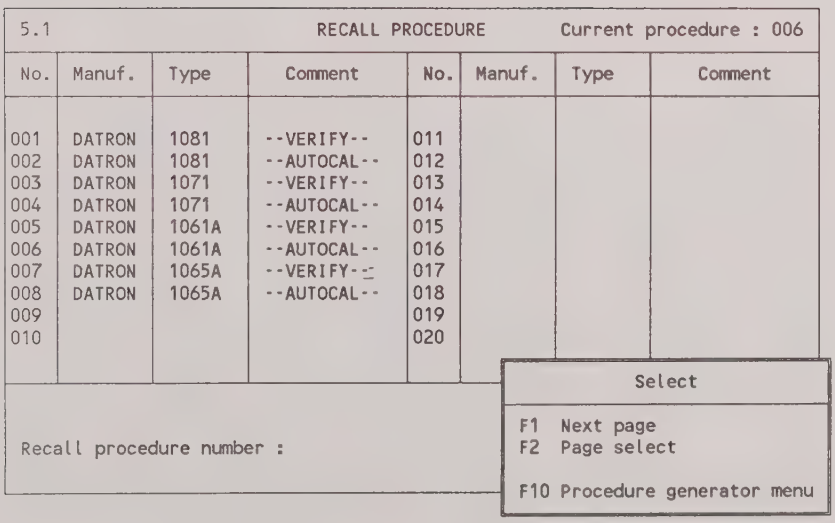


Fig 9.3 Recall Procedure Menu

At any point in this process, selection of function key F10 (Procedure Generator Menu) will return the Procedure Generator Menu (Fig 9.2) to the screen.

Having recalled a procedure into the temporary file, the other Procedure Generator facilities may be used to edit, save, or print that procedure. The procedure will remain, unmodified, in the temporary file until it is edited or another procedure is recalled into the temporary file. Therefore, a procedure may be edited, saved, run, and then edited again without the need to recall it first.

9.5.3 Datron Provided Procedures

The 4101B software is supplied with example procedures written for the Datron Autocal range of DMMs. Procedures 001 to 008 include full electronic calibration and verification procedures for the Datron 1081, 1071, 1061A and 1065/A, which have been fully tested and are supported by Datron.

9.6 Save Procedure

9.6.1 Introduction

Before a procedure held in procedure number 000 (the temporary file) may be run against an instrument, it must first be saved into the Procedure Library.

9.6.2 Operation

Selecting function key F3 (Save Procedure) on the Procedure Generator Menu (Fig 9.2) will cause a flashing cursor to appear against the password box. The Procedure/Certificate Generator password must now be entered in order to display the Save Procedure Menu (Fig 9.4). This is designed to prevent unauthorised modification of calibration procedures.

The first page of twenty procedures is shown and access to all 999 procedure numbers can be achieved through the use of the F1 (Next page) and F2 (Page select) function keys, as in paragraph 9.5.2.

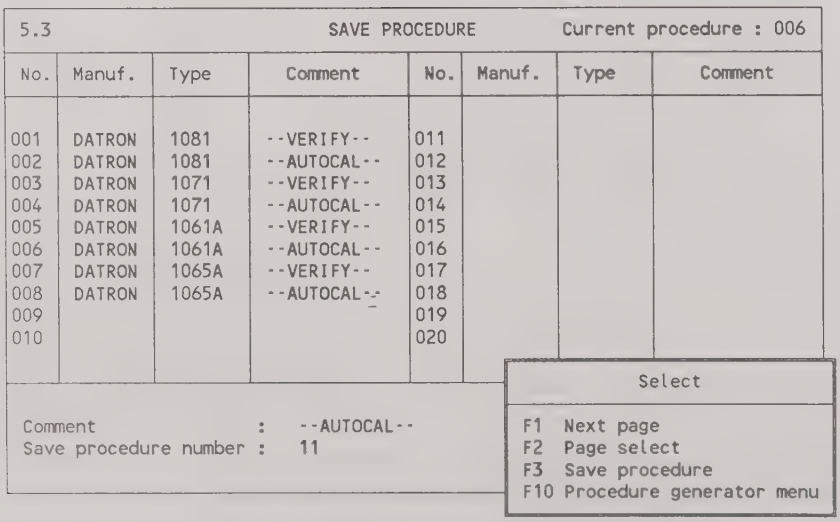


Fig 9.4 Save Procedure Menu

A comment may be entered which serves to distinguish between similar procedures. After selecting the ↵ key, a procedure number can be entered followed by the ↵ key and function key F3 (Save Procedure). The procedure is then saved on disk. The message "Saving Procedure XXX" will be displayed during the saving process, and the message "Procedure saved successfully " will be displayed when the process has successfully completed.
A warning will be given if the required procedure number has already been allocated to another procedure. In such a situation, selection of function key F3 will cause the old procedure to be overwritten by the version held in the temporary file.
Once the procedure has been saved, selection of function key F10 (Procedure Generator Menu) will display the Procedure Generator Menu (Fig 9.2)

9.6.3 Incomplete Procedures

During the Save Procedure process, the procedure is checked for completeness. If a procedure is saved which is not complete, an asterisk (*) is displayed against that relevant procedure number in the procedure library. This procedure cannot be run against an instrument until it is made complete, and re-saved. For further information, refer to paragraphs 9.9.7, 9.9.10.4, 9.10.3, 9.10.7, 9.10.13.

9.7 Delete Procedure

9.7.1 Introduction

This program allows an operator to erase an obsolete procedure from the disk.

9.7.2 Operation

Selection of function key F5 (Delete Procedure) on the Procedure Generator Menu will cause the cursor to flash against the password box. Correct entry of the Procedure / Certificate Generator password will present the Delete Procedure menu (Fig 9.5) on the screen. The first page of 20 procedures will be displayed and access to all 999 procedures may be achieved through the use of the F1 (Next page) and F2 (Page select) function keys, as described in paragraph 9.5.2.

Enter the number of the procedure to be deleted, press the ↵ key, and then select function key F3. This deletes the procedure, erasing all references to this procedure from the disk and from the library of procedures. After the procedure has been deleted, selection of Function key F10 (Procedure Generator Menu) will return the Procedure Generator Menu (Fig 9.2) to the screen.

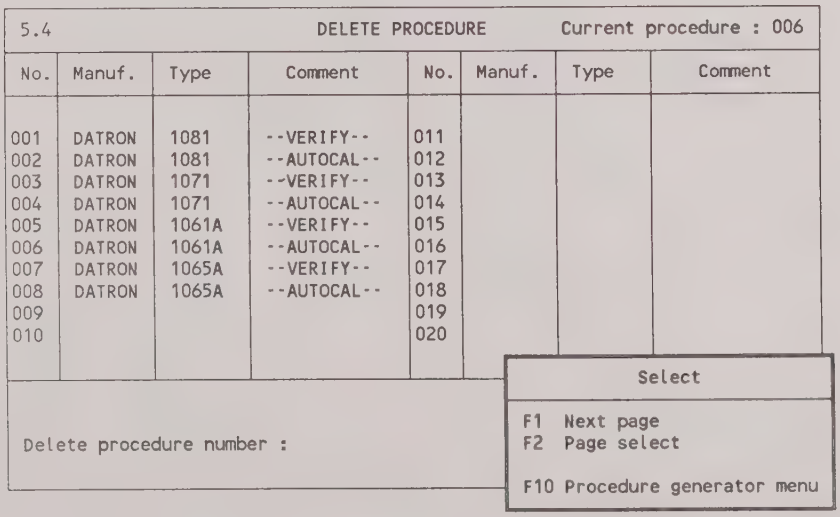


Fig 9.5 Delete Procedure Menu

9.8 Define /Edit Procedure

9.8.1 Introduction

This program is used to define or edit the sequence or content of calibration procedures that are held in the temporary procedure file, procedure number 000. Before this procedure may be run, it must first be saved into the library (refer to paragraph 9.6). Details on the required sequence of operations, how the instrument under test is to be controlled, and the specifications against which the instrument is to be calibrated, are entered using this program and stored on disk as a procedure.

9.8.2 Operation

Selection of function key F2 (Define/Edit Procedure) on the Procedure Generator Menu (Fig 9.2) will cause another set of selections to be offered, listed in the New/Existing Menu (Fig 9.6).

The selection of F1 (Continue with Current Procedure) will allow the editing of the procedure that is stored in the temporary file, procedure number 000. Selecting F2 (Initialise New Procedure) will initialise the temporary file and overwrite any information previously held.

9.9 Developing a New Procedure.

The process for editing an existing procedure is detailed in paragraph 9.12.

From the New/Existing Procedure Menu (Fig 9.6), select function key F2 (Initialise new procedure) to display the Define/Edit Procedure - Function Menu (Fig 9.7)

9.9.1 Test Point Number

The structure of a procedure is known as a "tree". At different levels in this tree, different information is significant.
At the uppermost level of the tree is stored information applicable to the whole procedure - for example: the Manufacturer and model number of the instrument, and certain information on the IEEE-488 operation of the instrument. The entry of this information is allowed only once, at the uppermost level of the Procedure Generator program.
At the next level down in this tree is stored information on the various measurement functions available from the instrument under test. It is necessary to enter certain details about the operation of the instrument in this measurement mode, as many times as there are measurement functions, thus allowing for instruments that operate differently in different measurement modes.

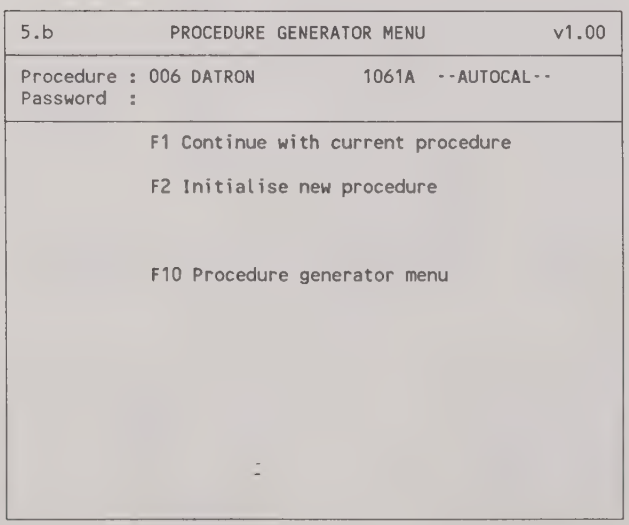


Fig 9.6 Procedure Generator - Define New / Edit Old Menu

For each measurement function in the tree, there are a number of different "branches" underneath, which correspond to individual ranges within individual measurement functions.
Underneath each range, there may be a number of different test values, and, in the case of the AC functions, underneath each test value there may be a number of test frequencies

During the procedure generation process, and at any time when running a procedure, there will be a test point number displayed in the top right hand corner of the screen, in the format 01.01.01.01. Reading from left to right, these numbers refer to function, range, test value and frequency, respectively. For example, the test point number 02.03.02.01 refers to the second function, third range (of that function), second test value (of that range), and first frequency (of that test value).

This numbering system uniquely identifies the position within a procedure of a particular test point and also defines the sequence in which all test points will be carried out (i.e. 01.01.01(.01) is the first test point and 10.99.99(.99) is the last test point possible for any particular sequence).

If at any point, a pair of digits is displayed as 00, this indicates that the information displayed is applicable to the next highest level. For example, if a test point is displayed as 00.00.00.00, this indicates that the information displayed is applicable to the whole procedure.

9.9.2 Manufacturer

Enter the make of instrument (for example DATRON) followed by the ↵ key. When the procedure has been saved, this information will appear in the manufacturer field in the procedure library listings (Figs 9.3, 9.4, 9.5) and the details of the procedure displayed in Fig 9.2.

9.9.3 Procedure Reference

If required, a reference to the source material from which the procedure was developed may be entered. For example, in the case of the eight Datron procedures, this is the part number and the issue level of the calibration and servicing manual for the individual instruments.

The Procedure Reference may be printed out on the head page of the calibration certificate, if required.

5.2 DEFINE/EDIT PROCEDURE - FUNCTION MENU 00.00.00.00

Manufacturer : DATRON	Type number : 1061A
Procedure reference : 850045/9	Calibration type : El. cal
Specification period : 1 days	Number of functions : 6
Enter pre/post-run instructions	Enter IEEE I/O specification

No.	Function	Cert Spec	Function IEEE Code	Ranges entered
1	Special	Special	F3	Yes
2	DCV	DCV	F3	Yes
3	Ohms	Ohms	F1	Yes
4	ACV	ACV	F2	Yes
5	DCI	DCI	F5	Yes
6	ACI	ACI	F4	Yes
7				
8				
9				
10				

Select

F9 Function entry
F10 Procedure menu

Fig 9.7 Procedure Generator - Function Menu

9.9.4 Specification Period

Procedures can be written which test an instrument to any user entered specification, e.g. 90 days, 1 Year, etc. Enter the period in days over which the specifications tested to will be valid, followed by the ↵ key. Note that the specification period entered here is not the specification period used in calculations of re-calibration dates. The period entered here is purely an easy-to-access remider of the specifications that will be applied to an instrument calibrated or verified with this procedure.

9.9.5 Type Number

Enter the model or type number of the instrument under test (e.g. 1061A) followed by the ↵ key. The information entered in this field will appear in the manufacturer field in the procedure library listing (Figs 9.3, 9.4 and 9.5) and in the details of the procedure displayed in Fig 9.2.

9.9.6 Calibration Type

At this point in the procedure development the select box will list the various types of calibration processes available with the system software.

Throughout the following descriptions the term 'verify' is used to identify the testing of an instruments against a specified performance, whereas the term 'calibrate' is used to imply physical or electronic adjustment of an instrument in order to make it meet the required specifications.

Seven types of calibration procedure are available:

F1 Electronic Cal - Full automatic calibration adjustment of instruments supporting some form of electronic calibration over the IEEE-488 bus (e.g. Datron AUTOCAL DMMs).

F2 IEEE Ver/Cal - Full performance verification of an IEEE-488 controlled instrument, with manual calibration adjustment instructions ONLY for those points which fall outside the borderline specifications limits. For a definition of borderline, refer to section 10, paragraph 10.5.3.2.

F3 IEEE Calibrate - Full manual calibration adjustment instructions are displayed at EACH test point while the instrument is under control from the IEEE-488 bus.

F4 IEEE Verify - Full automatic performance verification of an instrument under control from the IEEE-488 interface. No adjustment instructions are given.

F5 Man. Ver/Cal. - Complete performance verification of a manually controlled instrument with calibration adjustment instructions shown ONLY for those points falling outside borderline specification limits. For a definition of borderline, refer to section 10. paragraph 10.5.3.2.

F6 Man. Calibrate - Complete adjustment instructions for all functions of a manually controlled instrument.

F7 Man. Verify - Full performance verification of a manually controlled instrument. No adjustment instructions are given.

These seven calibration types can be split into three major groups:

i) Instruments capable of electronic calibration (Electronic Cal) under control via the IEEE-488 interface.

ii) Instruments controlled over the IEEE-488 interface, but manually adjusted where appropriate (IEEE Ver/Cal, IEEE Calibrate, IEEE Verify).

iii) Manually controlled and adjusted instruments (Man. Ver/Cal, Man. Calibrate, Man. Verify).

The selection of calibration type has fundamental effects in two areas.

i) The types of questions asked by the Procedure Generator depend on the Calibration Type. For example, it is pointless to ask questions on the IEEE-488 specification of a manually controlled instrument.

ii) When editing a procedure, it is only possible to edit a procedure in the same class as the one that is required. For example, it is possible to edit an IEEE Verify procedure to create an IEEE Ver/Cal procedure. However, it would not be possible to convert an IEEE Verify procedure into a Manual Verify procedure. Also, an Electronic Cal procedure cannot be changed to any other type.

Select the function key for the required 'calibration type' followed by the ↵ key.

9.9.7 Number of Functions

Typically, a procedure will be divided into a number of functions, for example DCV, ACV, RESISTANCE, DCI, ACI. At run-time, the operator of the system may elect to omit certain functions from the procedure run against the instrument (refer to section 7, paragraph 7.1.2.14). This is particulary useful in the case where a procedure has been developed for an 'loaded' instrument, but it is to be run against an instrument that does not contain all of the available options.

Enter the number of functions for the type of instrument followed by the ↵ key. A maximum of 10 functions is allowed. Note that during the Save Procedure process (paragraph 9.6), the procedure is checked for completeness. The number of functions in the procedure, as defined here, is checked against the number of functions that have been entered.

9.9.8 Enter Pre/Post-Run Instructions

Selection of function key F1 (Pre run) will display the Define/Edit Procedure Pre-run Instructions menu (Fig 9.8) where lines of text may be entered which will be displayed to the operator before the calibration sequence begins. This can be used, for example, to inform the calibration technician prior to calibration of the necessary switch settings and connection details required for the instrument under test.

Selection of function key F2 (Post run) will display the Define/Edit Procedure Post-run Instructions menu, which is identical to the Pre-Run Instructions menu, where lines of text may be entered which will be displayed to the operator after the calibration sequence ends. The appearance and operation of this menu is identical to that of the Pre-Run Instructions menu. This may be used, for example, to instruct the operator to disconnect the instrument, print out the calibration certificate, and remove the instrument to the storage location.

Selection of the ↵ key will bypass pre/post-run instructions.

For both pre-run and post-run menus, the instruction window at the bottom of the menu indicates how many lines of text are available and the process involves no more than typing the appropriate text into the inverse video area at the top of the menu.

For both the Pre- and Post- Run Instruction fields, full text editing facilities as described in section 5, paragraph 5.2 are available, so that text may be laid out as required. The Select Box offers the additional facilities of Clear Entry, Initialise Entry, Insert Line and Delete Line.
The only one of these facilities which is not obvious is Initialise Entry which allows the user to recall previously 'entered' text which has then been cleared using Clear Entry. (Note: the action of leaving the menu causes the text to be 'entered')

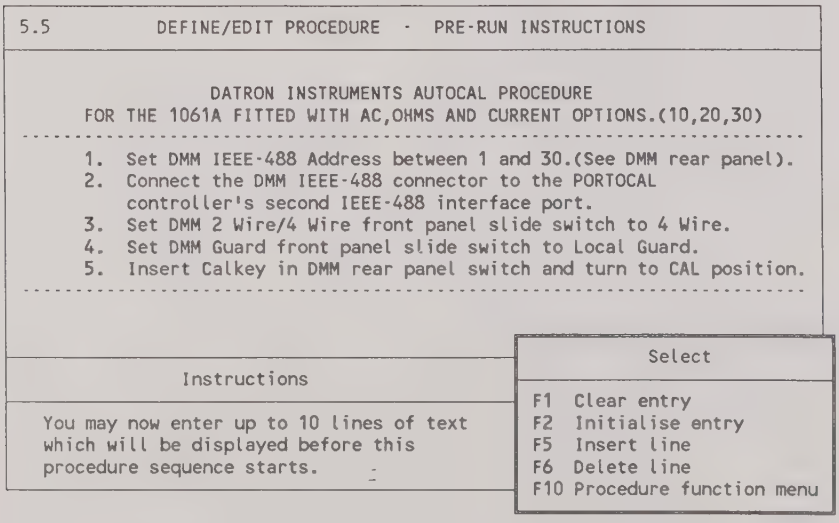

5.5 DEFINE/EDIT PROCEDURE - PRE-RUN INSTRUCTIONS
DATRON INSTRUMENTS AUTOCAL PROCEDURE
FOR THE 1061A FITTED WITH AC,OHMS AND CURRENT OPTIONS.(10,20,30)
1. Set DMM IEEE-488 Address between 1 and 30.(See DMM rear panel).
2. Connect the DMM IEEE-488 connector to the PORTOCAL controller's second IEEE-488 interface port.
3. Set DMM 2 Wire/4 Wire front panel slide switch to 4 Wire.
4. Set DMM Guard front panel slide switch to Local Guard.
5. Insert Calkey in DMM rear panel switch and turn to CAL position.
Instructions
You may now enter up to 10 lines of text which will be displayed before this procedure sequence starts.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Procedure function menu

Fig 9.8 Procedure Generator - Pre-Run Instructions Menu

9.9.9 Enter IEEE I/O Specification

This selection is blanked if the instrument to be tested is a manually controlled instrument.
If, however, the type of calibration required is for either an IEEE-488 controlled instrument or for an instrument possessing IEEE-488 calibration facilities, then selecting function key F1 (Yes) will invoke the Define/Edit Procedure - IEEE I/O Specification menu (Fig 9.9), where precise details on how to control the instrument under test over the IEEE-488 interface can be entered.

The details that need to be entered in this menu can all be found in the handbooks for the instrument that requires calibration. However, it is important to understand how the particular instrument is controlled and interrogated via the IEEE-488 interface in order to make best use of that information.

Selection of function key F2 (No) or the ↵ key will bypass this entry and move the cursor on to the function entry section of the Define/Edit Procedure Function Menu page (Fig 9.7).

```
5.6      DEFINE/EDIT PROCEDURE  -  IEEE I/O SPECIFICATION

  Controller to instrument termination :                    EOI
  Instrument to controller termination : Cr                 EOI/Lf

  IEEE handshake timeout     : .200 (secs)
  Initialisation string      : Q1T2A0
  Reading trigger            : GET
  Reading ready indication   : SRQ          Timeout : 45   (secs)
  Calibration enable string  : W1
  Numeric entry cal code     : K             Format : +1.00000E+00

                        Reading format
  Maximum length of reading string : 15
  Polarity position                : 1
  Start position of numeric value  : 2
  Number of characters in value    : 13

        Status byte format
  Reading ready status : 0 1 x x x x x x
  Reading error status : 1 1 x x x x x x

                Select

  F1  Cr (Carriage return)
  F2  Lf (Line feed)
  F3  Esc (Escape)
  F4  ASCII code

  F10 Procedure function menu
```

Fig 9.9 Procedure Generator - IEEE I/O Specification Menu

9.9.9.1 Controller to Instrument Termination

Different IEEE-488 controllable instruments require different command string terminators, in other words, the controller needs to add the correct 'tail' to each command sent to the instrument.

The Select Box gives the available choices. The symbol EOI indicates that the IEEE-488 control line "End or Identify" will always be asserted with the last byte sent to the instrument. In addition, up to three different terminators may be entered to complete the 'tail', followed by the ↵ key.

The possible entries are:

F1 Cr (Carriage Return, ASCII 13)
F2 Lf (Line Feed, ASCII 10)
F3 Esc (Escape, ASCII 27)
F4 ASCII code. This allows any keyboard character to be entered as a terminator. In addition, any 3-digit decimal number enclosed in round brackets, (), will result in that ASCII code being sent to the instrument under test. For example, if a terminator is entered as (027) EOI, the Esc character coincident with EOI will be added to any command string sent to the instrument.

For most instruments, the sequence Cr Lf / EOI will work. However, it may be necessary to consult the relevant section of the instrument's programming manual.

9.9.9.2 Instrument to Controller Termination

Similarly, different instruments may append different characters or combinations of characters to the end of a string returned to a controller, indeed, it is often a programmable parameter in the instrument.

The 4101B software will ALWAYS terminate the instrument read if the instrument asserts the IEEE-488 EOI command line, or if the instrument sends a Lf (Line Feed) character, or both. The optional characters entered here are merely removed from the end of the returned string prior to interpretation of the returned string.

For the vast majority of instruments, the sequence Lf / EOI will work. However, it may be necessary to consult the relevant section of the instrument's programming manual.

9.9.9.3 IEEE Handshake Timeout

When a controller attempts to send a command to an instrument via the IEEE-488 bus, the data is exchanged using a handshake mechanism; ie the controller, or "talker" in effect, says "I have a message" and will stay in that state until the instrument (or "listener") says "I have recieved your message".
The main disadvantage with this mechanism is that during the first phase of the transfer, control of the transfer is relinquished by the talker. If, in the simplest case, the listener is not connected to the IEEE-488 interface, then the talker will never recieve the handshaking signals that it is waiting for.
Therefore there is a mechanism, known as the Handshake Timeout, whereby the talker aborts the attempted transfer if the listener has not acknowledged the transfer within a certain time period, known as the IEEE Handshake Timeout.

For the majority of instruments, a IEEE Handshake Timeout of 0.2 secs will be sufficient. Some instruments, however, will hold the handshaking lines of the IEEE-488 interface for longer, for instance, during a device reset command, or while calibration is taking place.
In addition, some instruments have a programmable mode, in that the user may specify whether or not the handshake lines are held during certain operations, in which case, it is recommended that the "non-handshaking" mode is selected.

9.9.9.4 Initialization String

After the 4101B has automatically located the address of the instrument under test, if that facility is enabled (refer to section 7, paragraph 7.1.2.18), the commands entered in this field are sent to the instrument. These commands would typically used to reset the instrument, set up the trigger and SRQ modes. Any valid instrument command string may be entered here, followed by the ↵ key.
This command string is sent only once, after the pre-run instructions (if any) and after the address autosearch routine (if enabled).

9.9.9.5 Entering IEEE command strings.

At any point in the procedure generator, where a command string is entered to be sent to the instrument under test, there are 256 character positions available. If more characters are entered than will fit in the window in the menu, the window will "scroll" and the characters < and > will indicate that more characters exist to the left and right respectively. The cursor may be controlled by the ← , → , Insert and Delete keys. In addition, two "hidden" function keys, shift-F7 and shift-F8 may be used to take the cursor to the beginning and end of the window respectively.

If the keyboard does not contain a character that is to be sent to the instrument under test, it is possible to specify any ASCII character by entering a 3-digit number corresponding to the character's ASCII value, in decimal, surrounded by (and).

For example:

(013) Will result in a carriage return being sent.

(065) Will result in an A being sent.
For a table of ASCII characters, and their codes, refer to the relevant manual supplied with your computer:

For IBM-XT users, refer to Appendix D of the Basic Manual.
For HP-Vectra users, refer to pages B3 to B13 of the Basic Manual.
For Compaq II users, refer to Appendix B of the MS-DOS Reference Guide.

In addition, if it is required, certain control characters may be entered into the IEEE command string fields.

Cr will cause a carriage return (ASCII 13) to be sent.

Lf will cause a line feed (ASCII 10) to be sent.

Sdc will cause a Selective Device Clear (the IEEE-488 Sdc command) to be sent.

Gtl will cause a Go To Local (the IEEE-488 Gtl command) to be sent.

GET will cause a Group Execute Trigger (the IEEE-488 GET command) to be sent.

Note that:

a) Both the Sdc and Gtl commands will only operate if they are the only commands entered in the string.

b) For the above mentioned functions, the upper and lower cases used above must be followed.

9.9.9.6 Reading Trigger

This field is used to inform the 4101B software on how to command the instrument to initiate a reading. Most IEEE-488 compatible instruments posess variable trigger modes, in that they may be set up to take readings in a variety of ways. For example, Datron Autocal DMMs may operate in any one of the following modes:

a) Free-running internal triggers
b) External triggers supplied by external circuitry
c) GET or the ASCII symbols @ and J
d) GET, @, J or external triggers.

It is recommended (but not mandatory) that the instrument under test is synchronized to the Portocal system, which in the case of the Datron Autocal DMMs, is mode c) above. It will be necessary to refer to the instrument's programming manual for information on how to place the DMM in this mode.

The entry in this field is taken as the default trigger for each reading, and may be over-ridden for each individual testpoint as required in the testpoint entry page.

The possibilities are either a Group Execute Trigger (GET) or any combination of ASCII codes.

To enter a GET, select F1, and the highlighted cursor will automatically skip to the next field (Reading Ready Indication).

To enter an ASCII trigger code, select F2, which will automatically take the highlighted cursor to the newly created field "Code" to the right. Enter the required trigger code followed by the ↵ key.

9.9.9.7 Reading Ready Indication

This field informs the Portocal software on how it is to know that the instrument under test has a reading ready for the controller.
This may be accomlished in one of two ways: either through the use of Service Requests (SRQ's) or by timeouts (waiting a given amount of time after the reading trigger before attempting to read the instrument under test).

It is recommended, wherever possible, to synchronise on SRQs, firstly for maximum system speed, and secondly, to provide more comprehensive error trapping in the case of a faulty instrument.

Select F1 for synchronisation by SRQs, which will automatically take the highlighted cursor to the next field, "Timeout". After sending a reading trigger to the instrument under test, control effectively passes to the instrument, and the Portocal Software is waing for a certain response (a SRQ interrupt) before regaining control. If, for some reason, the SRQ never arrives, the Portocal software must regain control and report this problem to the operator.
The number entered here is the number of seconds that the 4101B software will wait between the sending of a reading trigger and the reception of a service request. If the service request does not arrive before the specified time period, the 4101B software will suspend execution of the procedure and display a message to this effect ("98/18000 Instrument SRQ time out").
For the vast majority of instruments, an SRQ timeout of 10 or 15 seconds should be sufficient, but in some cases, it may be necessary to extend ths further.

Select F2 for synchronisation by timeouts, which will automatically take the highlighted cursor to the next field, "Timeout". Enter the required timeout followed by the ↵ key. During calibration, the 4101B software will send the trigger code, wait for the specified timeout period, and then read the instrument. The instrument should be programmed into single trigger mode, and should automatically place each reading taken in its output buffer.

9.9.9.8 Calibration Enable String

This prompt only appears if the procedure is being generated for an instrument with electronic calibration facilities, such as Autocal (refer to paragraph 9.9.6). The string entered here is intended to be used to place the instrument under test into calibration mode. It is appended to the front of the calibration trigger (refer to paragraph 9.10.24) specified in the testpoint entry page, EVERY time a calibration trigger is sent to the instrument. Some instruments, however, require that the calibration enable string is sent onl;y once, in which case, it will be necessary to insert the calibration enable string required into a field that is sent only once, such as the Initialization string (paragraph 9.9.9.4).

Enter the ASCII code that is required to be appended to the front of the calibration trigger, followed by the ↵ key.

9.9.9.9 Numeric Cal Code and Format.

These prompts only appears for Electronic Calibration Procedures.(paragraph 9.9.6)

Many instruments incorporating some form of electronic calibration (eg Autocal) may be calibrated at cardinal points, eg a nominal 1.0000000kΩ is applied to the input terminals and the required calibration trigger is applied. However, it is unlikely that the actual value of the calibrator's resistance is a nominal 1.0000000kΩ, so the majority of instruments posessing some form of Autocal allow the controller to inform the instrument of the actual value applied before the calibration trigger is sent.

The precise values of these resistors are stored by the system every time the calibrator(s) are 'read' using the Manager - System Configuration Menu. When the calibrator(s) is/are recalibrated, these values will change and therefore any procedures that may have made use of the old values would need amending. As this could be extremely inconvenient, the user is instead only allowed to enter exact cardinal point values in the procedure generator. However, when the procedure is run (i.e. 10.00000 Ohms or 10.00000k Ohms) using the Calibrate program, the true value of the resistor (e.g. 10.0004 Ohms or 10.00011k Ohms) is substituted for the dummy cardinal value. This allows old procedures to work with the latest calibrated set of resistor values.

The use of the Numeric Entry Cal Code field and the Format field is tied in with the calibration trigger for each testpoint (refer to paragraph 9.10.24) entered in the test point entry page. The optimum way to explain their interaction and the resulting data sent to the instrument under test is by the use of an example:

i) If the exact value of the resistance to be applied is 1.000123 kΩ,

Numeric Entry Cal Code:	K
Format:	+1.000000E+01
Calibration Trigger:	K+1.000000E+01G1
Data sent to instrument after stimulus applied:	K+1.000123E+03G1

When, at run-time, the calibrate program encounters a calibration trigger which starts with the Numeric Entry Cal Code followed by a number in the same format as that in the Format field, the number in the Format and Calibration trigger fields is replaced by the precise value of the stimulus, in that format, and finally, the tail of the calibration code is added. This string is then sent to the instrument.

9.9.9.10 Reading Format

The next four fields are used to inform the Portocal software of the format of the reading string returned by the instrument under test.

i) Maximum length (number of characters) of reading string. If the reading string length is variable, then the longest length possible should be entered.

ii) Polarity position: if the reading string will contain a polarity sign, then the position (from 1 to N) of the polarity sign should be entered here. If there is no polarity sign, enter 0.

iii) Start position of numeric value: the start position of the numeric value should be entered here.

iv) Number of characters in the value: the number of character that go into making up the numeric value in the reading string should be entered here.

For example: if the reading string is in the format +1.234567E+01VDCCrLf, then the entries in the reading format section would be:

Max length of string: 18
(counting all spaces, punctuation, Carriage Return and Line Feed characters, noting that the EOI control line is NOT a character.)
Polarity position: 1
Start position of numeric value: 2
Number of characters in value: 12
(counting the decimal point)

Many instruments have a variable length reading string, as different measurement functions often produce different numbers of reading digits. If this is the case, it will be necessary to enter the longest possibilities. At run time, if the any of the values programmed above are longer than those in the string returned (ie there are only 11 characters in the value returned), then the value will still be interpreted correctly. If, however, there are 13 characters in the numeric value returned, then the right-most character will not be interpreted.

If the reading ready indication chosen earlier was Timeouts, then the F10 function key is available to return to the Define/Edit Procedure - Function Menu (Fig 9.7).

9.9.9.11 Status Byte Format

This block will only be accessible if SRQ was chosen as the reading ready indicator (paragraph 9.9.9.7) The SRQ (service request) line is associated with a one-byte status word generated by the instrument under test, which accessible to the controller when performing a serial poll function (SPOLL).
The Portocal software will read the status byte from the instrument under test (perform a SPOLL) on receipt of a service request. As SRQs may be generated by a wide variey of conditions (the condition will generally be indicated by the value of the status byte read), the 4101B must be informed of the status byte value for a good reading, and the status byte value for an error condition.

Function keys F1 to F3 can be used to enter 0, 1 or 'X' (don't care) at the necessary locations in the displayed status bytes for both Reading Ready Status and Reading Error Status. The ↵ key can also be used to bypass each bit. Note that bit 7 (with bit one on the right and bit 8 on the left) is set to a 1, and connot be changed. This bit is called the RQS bit (request for service), which will always be asserted by the requesting instrument.

As mentioned earlier, the Portocal software will perform a SPOLL, reading the status byte on reciept of an SRQ. The sequence of events is as follows:

i) This received status byte is first checked for a match with the reading error mask entered here. If it matches, then the calibrate program will immediately halt and display the message "100/39000 Instrument IEEE error (&HXX) Select F1 Cont Esc Abort", where XX represents the value (in hexadecimal) of the received status byte.

ii) The received byte is then checked for a match with the reading ready mask entered here. If it matches, then the program will attempt to extract the reading from the instrument under test, display the test value and proceed to the next testpoint as applicable. If the system is unable to read the instrument (which will typically be the case if the buffer is empty), then the message "100/18000 Instrument IEEE time out" will be displayed.

iii) If the received byte matches neither the reading ready or the reading error mask entered here, then the Portocal software will ignore this SRQ and wait until either
a) another SRQ is detected or
b) an SRQ timeout occurs (in which case the calibrate program will halt and display the massage "98/18000 Instrument SRQ time out F1 Cont Esc Abort").
This is necessary as some instruments raise a service request (SRQ) immediately an A to D cycle starts (ie a 'busy' SRQ')

As a last resort, entering 1111 1111 as the reading error status byte and X1XX XXXX as the reading ready status byte will result in every SRQ being treated as a reading ready SRQ (assuming that the status byte pattern 1111 1111 will not occur). This is not a recommended method, as errors detected by the instrument under test are never reported to the Portocal software.

Once the Status Byte Format has been entered, selection of function key F10 (Procedure Function Menu) will cause the Define /Edit Procedure - Function Menu (Fig 9.7) to be displayed.

9.9.9.12 Preliminary Corrections

If necessary, any of the entries discussed so far can be corrected with the exception of Calibration Type. Select function key F3 (Previous block) to move the highlighted cursor to the top of the menu (to the Manufacturer field) and then use the ↵ key to step from entry to entry.
As the data required by the Procedure Generator for different types of procedure is different, to change calibration type to one outside the existing class (ie IEEE-based to Manual-based, or Electronic Cal. to any other), it is necessary to return to the Procedure Generator Menu (Fig 9.2), reselect Define/Edit Procedure (F2) and reinitialise a new procedure (F2).

9.9.10 Function Entry

Having entered the preliminary details of the procedure, selection of function key F9 (Function Entry), or the ↵ key as necessary, will move the inverse video bar to the start of Function Entry position (the bottom half of Fig 9.7). Up to ten separate functions may be entered for any given procedure, though the program will only allow entry of as many functions as the 'Number of Functions' (paragraph 9.8.4.7) already entered.

For many instruments, certain measurement functions are options, and are not automatically included in every instrument. In this case, it is usefull to split the calibration procedure so that any optional facilities are contained in separate functions. In this way, at run-time, the operator is able to use the Edit / Test procedure facility (refer to section 7, paragraph 7.1.2.15) to edit out the tests of any optional facilities, rather than keep numerous different procedures on file for each possible instrument configuration.

9.9.10.1 Function

Selecting function key F1 (Select Funct.) will cause a list of functions to be displayed in the select box. These functions refer specifically to the instrument under test and will include all normal multimeter functions.
The only function that requires explanation is 'Special'. This may be selected for peculiar or unusual tests, such as input bias current checks, earth checks, common mode rejection tests, and so on.
To gain a full understanding of the potential uses of the Special function, it is necessary to gain a full understanding of procedure generator, so the use of the Special function is described in paragraph 9.11.

Make the required function selection and press the ↵ key. It should be noted that the sequence in which these functions are entered determines the sequence in which all the tests are carried out by the Calibrate program.

9.9.10.2 Cert. Spec.

At the foot of each results page of the full calibration certificate, the system normally prints out the uncertainty of the calibration source. These uncertainties can be defined and edited by the user in the Certificate Generator program, section 10, paragraph 10.5.4.

Cert. Spec. allows a choice to be made as to which specifications are printed against certain results, and provides some flexibility for unusual tests (e.g. Special Function).

The system normally assumes the Cert. Spec. will match the Function. However, should this not be the case, a different Cert. Spec. may be chosen from the Select Box. Press the ↵ key to continue.

9.9.10.3 Function IEEE Code

If the previously selected Calibration Type is for a manually controlled instrument, then this entry is not required and indeed, is not accessible.
For IEEE-488 controlled calibrations, however, any command string may be entered here that will be sent once to the instrument under test immediately before the ranges and testpoints within that function are executed. The ↵ key terminates the entry and moves the cursor to the Test Points Entered field. Refer to paragraph 9.9.9.5 for further information regarding the entry of data in this field.

9.9.10.4 Ranges Entered

This column gives an indication as to whether or not the defined number of ranges have been entered. Note that the data displayed in this field should NOT be used as an indication of the completeness of a function. Selection of function key F2 (Next function) or the ↵ key will move the highlighted cursor to the next line of function entry (if there are more functions to be defined). However, if it is wished to completely define one function at a time, selection of function key F1 (Enter points) will display the Define/Edit Procedure - Test Point Entry Menu (Fig 9.11), where the details of all the ranges and test values for that particular function may be entered, before returning to the Define/Edit Procedure - Function Menu in order to define the next function.

When all the function details have been entered, selection of the ↵ key will return the highlighted cursor to the first function, where further presses of the ↵ key will scroll the cursor down the page, function by function.

9.9.10.5 Inserting and Deleting Functions.

With the highlighted cursor in the collumn headed "function", selection of function key F6 (Delete Funct.) will delete the function currently picked out by the highlighted cursor from the list, and will also erase any test point information that may have been previously entered against that function. Any functions listed below the deleted function will move upwards by one function.

Function key F5 (Insert Funct.) may be used to insert new functions within the list of functions, providing the 'Number of Functions' will not be exceeded. The new function is inserted at the position of the inverse video cursor, while the any existing function at that position, and all subsequent functions are moved down by one position.

At any time, selection of function key F7 (Enter points) takes the user to the Define/Edit Procedure - Test Point Entry page, where the test values and range details of the current function may be entered.

9.10 Define/Edit Procedure - Test Point Entry

9.10.1 Introduction

The test point entry page (fig 9.10) is used to enter the details of the individual test points within a chosen function. Each function may contain a number (up to 99 per function) of different ranges, which may, in turn, contain a number of different test values (up to 99 per range), which may, in the case of AC stimulii, contain a number of different test frequencies (up to 99 per test value).

The structure of a calibration procedure is described in paragraph 9.9.1. At each level in the tree, information may be entered that is significant to all the entries in the levels below. For example, if, in the range portion of the page, the signal source entry is specified as DCV, then all of the testpoints within that range will be sourced from the DCV capability of the calibrator(s).

At any point, the position of the highlighted cursor within the tree structure is indicated by the test point number displayed in the top right hand corner of the screen:

The first pair of digits indicates the function number (from 1 to 10).
The second pair of digits indicates the range within that function (from 0 to 99), with zero indicating that the highlighted cursor is located at the function level.
The third pair of digits indicates the test value number (from 0 to 99), with zero indicating that that the highlighted cursor is at either the function or range level.
The forth pair of digits, if displayed, indicates that an AC source is being used, and shows the frequency at which the cursor is located, from 0 to 99. If a zero is displayed, this indicates that the highlighted cursor is located at the test value level, range level or function level.

If a color monitor is being used, then the level within the tree at which the cursor is located is indicated by the position of the pair of highlighted digits within the testpoint number.

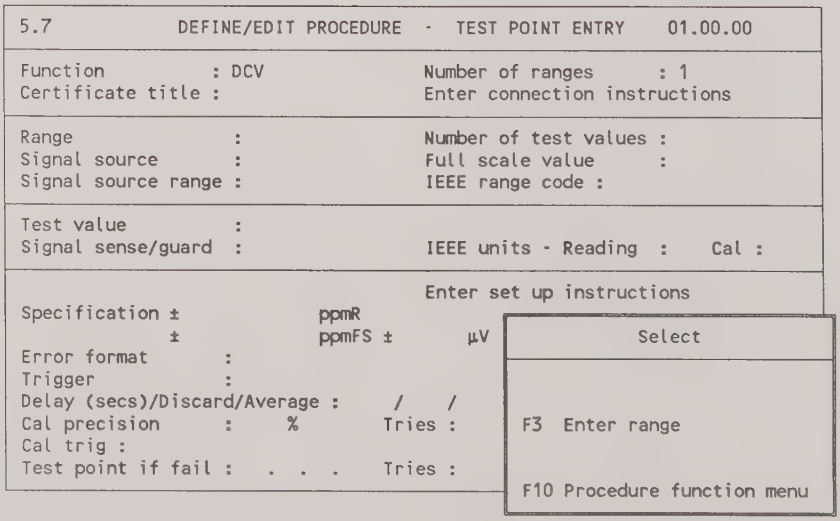

5.7 DEFINE/EDIT PROCEDURE - TEST POINT ENTRY 01.00.00
Function : DCV
Certificate title :
Number of ranges : 1
Enter connection instructions
Range :
Signal source :
Signal source range :
Number of test values :
Full scale value :
IEEE range code :
Test value :
Signal sense/guard :
IEEE units - Reading : Cal :
Enter set up instructions
Specification ± ppmR
± ppmFS ± µV
Error format :
Trigger :
Delay (secs)/Discard/Average : / /
Cal precision : % Tries :
Cal trig :
Test point if fail : . . . Tries :
Select
F3 Enter range
F10 Procedure function menu

Fig 9.10 Procedure Generator - Test Point Entry Menu

9.10.2 Function

This identifies the previously selected function for which the test points are to be entered. This will be the function specified in the function entry page (Fig 9.7), and within the test point entry page (Fig 9.10), this entry cannot be accessed.

9.10.3 Number of Ranges

Enter the number of ranges associated with this function followed by the ↵ key. A maximum of 99 ranges per function is permitted. For a procedure to be complete (and therefore executable), this number must match the number of ranges actually entered later.

9.10.4 Certificate Title

When the results for this particular function are printed on the calibration certificate results page, they will appear listed underneath this particular certificate title. This title also appears at the head of the Calibration in Progress Menu when the procedure is actually being run. Enter the required description followed by the ↵ key.

9.10.5 Enter Connection Instructions

This field allows the entry of four lines of instructions to be presented to the operator immediately prior to the execution of the tests within the current function. For example, this could be used to inform the operator to change the input connections to the DMM from a 2-wire voltage configuration to the 4-wire Ω configuration.

Selection of function key F1 (Yes) will display the Define/Edit Procedure - Connection Instructions menu (Fig 9.11), where these instructions may be entered. Full text editing facilities are available, as described in section 5, paragraph 5.2. The only one of these facilities which is not obvious is Initialise Entry which allows the user to recall previously 'entered' text (the action of leaving the menu causes the text to be'entered').

If no connection instructions are required, then selection of function key F2 (No) or the ↵ key will move the cursor past this selection, and at run-time, instructions will not be presented to the operator at this point.

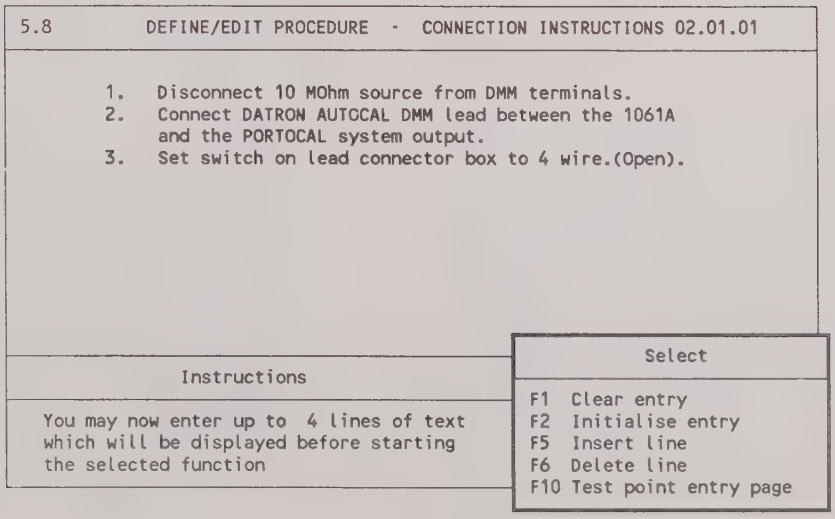

5.8 DEFINE/EDIT PROCEDURE - CONNECTION INSTRUCTIONS 02.01.01
1. Disconnect 10 MOhm source from DMM terminals.
2. Connect DATRON AUTOCAL DMM lead between the 1061A and the PORTOCAL system output.
3. Set switch on lead connector box to 4 wire.(Open).
Instructions
You may now enter up to 4 lines of text which will be displayed before starting the selected function
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Test point entry page

Fig 9.11 Connection Instructions Menu

9.10.6 Range

Range involves two entries: alpha-numeric characters followed by a scaling multiplier. This allows the range to be identified in realistic familiar units, e.g. volts, millivolts, kilohms, etc. The range does not necessarily need to be a number, but will typically be so. The range entered is not used in any subsequent calculations, and is merely stored in the results files and printed on the calibration certificate.

For example, if the function is DC volts and the first range to be tested is the 100mV range, type in 100, followed by ↵, followed by function key F4 (m [x 0.001]) to identify the range in the required format. Press the ↵ key to move onto the next prompt.

9.10.7 Number of Test Values

This represents the number of output amplitude settings which are required to test this particular range. The system will allow up to 99 test values to be entered per range. Enter the number of test values that are applicable to this particular range, followed by the ↵ key. Note that before the procedure is complete, and therefore executable, this number must correspond to the number of test points actually entered.

9.10.8 Signal Source

This refers specifically to the output signal from the calibration system. The system will normally assume that the 'source' is the same as the 'function'. However, should this not be the case, a different source may be chosen from the select box. For example, it may be required to supply high current from a transconductance amplifier being driven by the system to calibrate the 20 Amp AC range of a DMM. In such a case the 'Function' would be ACI but the 'Source' would be ACV.

If the signal source is specified as Special (F8), the calibrators are disabled (the output(s) are turned to the OFF state), and control is passed to the respective front panel switches. In this way, for example, it is possible to instruct the operator to connect a standard resistor to the input terminals of the DMM (using the Connection Instructions facility), and then calibrate the DMM to that value.
When a subsequent tespoint is encountered that uses the system calibrator(s), the 4101B software will automatically reset the calibrator(s) into a known state and program the correct settings for that test point.

Enter the signal source, if required, followed by the ↵ key.

9.10.9 Full Scale Value

Enter the maximum value which can be displayed on the particular range of the instrument. Like Range, Full Scale Value is entered in two parts: a number and a scaler.

The number entered has four uses:

i) Any test value for this range which is greater than full scale value will not be permitted by the program. This prevents the procedure from generating a signal which may damage an instrument. The one exception is in the case of a 'Special' function, where this check is suspended.

ii) The full scale value (FS) may be used in the specification calculation if the specification format selected uses % FS or ppm FS (Refer to paragraph 9.10.18).

iii) The number of digits entered for the full scale value (e.g. 19.9999) determines the number of digits displayed during calibration and also printed on the calibration certificate.

iv) A sign with the full scale value (e.g. +19.9999) will indicate to the system that displayed results should also have a sign (e.g. DCV). If, with DCV and DCI functions, the full scale value is entered without a sign in front, the procedure generator will NOT permit the entry of a negative test value.
An exception to this rule is in a 'Special' function, where this check is suspended.

Selecting the ↵ key will again display the selection of scalers from which an appropriate choice can be made, followed by the ↵ key.

9.10.10 Signal Source Range

The system calibrator(s) normally operate in autorange (Auto), supplying appropriate sources from the most accurate calibrator range for the test value. For certain measurements however, it may be advisable to force a particular calibrator range - especially for linearity and zero checks on high accuracy instruments.

Portocal's calibrators are highly linear. If a linearity check is carried out on the 10V DC range of a high accuracy instrument, it would be advisable to force the calibrator source range to 10V DC also. Any measurements then taken at 10% of range (i.e. 1V DC) would not then suffer from possible range change discontinuities in the linearity of the calibrator output, which may occur if the calibrator is in 'Auto' and changes to its 1V DC range for this output.

Similarly, care should be taken over range selection when calibrating DCV zero offsets in high accuracy instruments. When the signal source range is 'Auto', the zero provided by the DCV sources is a hard-wired short circuit. When forced to a range, however, the DCV zero will be the active zero output from that particular range, which due to amplifier offsets, may be slightly different from the zero provided in 'Auto'. These various zeroes should be used as follows:

If, for example, the 10V DC range of a high accuracy instrument is to be calibrated, it may be advisable to zero that instrument's range against the calibrator's 10V range active zero. This ensures that when the instrument's full range is compared against the calibrator's full range output, they are both working from the same zero reference and the instrument 'gain' is calibrated correctly.

Then, if required, the instrument's 10V range zero can be recalibrated against the short-circuit zero provided in 'Auto', to give a true zero.

The Select Box displays all the available ranges from which a choice may be made, followed by the ↵ key.

9.10.11 IEEE Range Code

This entry is blanked if the Calibration Type is for a manually controlled instrument. For all IEEE-488 controllable procedures, this field is available for the specification of a command string to be sent to the instrument, typically (but not confined to) setting up the measurement range required.
This command string, if entered, is sent to the instrument immediately after the connection instructions have been displayed (if applicable) and immediately before the test value is applied. Refer to paragraph 9.9.9.5 for details on the editing functions available and the data that is valid in this field.

9.10.12 Test Value

Enter the first required test value followed by the ↵ key, and then its scaler, again followed by the ↵ key.
The entered value will be checked for validity (ie that it does not exceed the full scale value entered for this range), and, if necessary, reformatted to match the number of digits entered in the 'Full Scale Value'.
The exception is in the case of a 'Special' function, where this manipulation is inhibited.

9.10.13 No. of Frequencies

This entry is blanked for all sources other than AC volts and AC current. It specifies the number of frequencies at which the test value is to be output. Up to 99 different frequencies may be entered for each test value (amplitude). Enter the required number followed by the ↵ key. Note that before a procedure is declared as complete, and therefore executable, the number of frequencies is checked for a match against the value entered here.

9.10.14 Signal Sense/Guard

Portocal's calibrators have the ability for remote sense of all voltage ranges from 1 volt to 1000 volts and can also provide 2 wire or 4 wire connection for all resistance ranges. Full control over local or remote guard connection for the calibrator's terminals is also provided, although under most circumstances, local guard is adequate.

Function keys F1 and F2 provide 2 wire Sense which is generally used for voltage calibration of a high input impedance devices, all current calibration, and 2 wire resistance calibration of low accuracy multimeters. Function keys F3 and F4 provide 4 wire Sense which can be used for voltage calibration of low input impedance devices or, alternatively, 4 wire resistance calibration where the effects of lead resistance can be eliminated.

Older generations of 4000A calibrators were designed so that the I+ and I- terminals were not isolated from the Hi and Lo terminals when in 2-wire voltage source mode. In this case, care should be taken when using 4-wire connections to certain instruments. If their current sourcing or measuring circuits are not isolated from the terminals when measuring DC or AC volts, incorrect lead connections may damage the instrument under test. To identify these 4000A's refer to the serial number located on the instrument's rear panel. If the last two characters of the serial number are -4, for example 15627-4, then the calibrator has automatic 4-wire isolation incorporated. Otherwise, the above warning should be heeded.

9.10.15 IEEE Units - Reading: Cal:

These entries are blanked for manually controlled instruments and 'Cal' is blanked for all but electronic calibration type procedures. They allow the user to inform the system of two things:

i) Whether the reading being taken from the instrument under test over the IEEE-488 bus is in different units to the normal Volts, Amps or Ohms. This is typically used when a DMM returns a reading, when measuring Resistance, of a number of kΩs. Selection of F2 (X 1000) will cause the calibration program to automatically multiply the reading obtained by 1000, so that the reading obtained is automatically converted to a number of Ωs, as opposed to kOhms.

ii) Whether the Ωs values sent as part of the calibration trigger for electronic calibration type procedures are expected by the instrument under test to be in Ω or kΩ. For instruments that operate on numbers of kΩ, as opposed to Ω, it will be necessary to select F4 (/ 1000) to ensure that the calibrated value is presented to the instrument under test in the correct units.

If necessary, make a choice from the Select Box and press the ↵ key to continue.

9.10.16 Frequency

For AC volts or AC current sources, the system will prompt for frequency values, followed by appropriate scalers. Once entered, press the ↵ key.
If the present function is not 'Special' all entered frequencies are checked to ensure they do not exceed the calibrator's capability, and do not exceed a 2 X 10E7 Volts/Hertz product, due to the capacitive affect of the standard, general purpose lead kit.
For a 'Special' function, the Volts/Hertz limitation is removed, so that through the use of more applicable lead setup, the full voltage/frequency profile of the calibrator may be used.

9.10.17 Enter Set-Up Instructions

This facility allows instruction text to be displayed to the calibration technician using the calibrate program on a per test point basis. It can be used, for example, to instruct the technician on the optimum lead connection configuration for any particular measurement. Any instructions entered here will be displayed to the operator after the IEEE range code (if applicable) has been sent to the instrument under test, and before the test value is applied.
Selecting function key F1 (Yes) will display the Define Procedure - Set-Up Instructions menu (Fig 9.12) For information regardng the editing facilities available within this page, refer to section 5, paragraph 5.2). Otherwise, selection of function key F2 (No) or the ↵ key will bypass this entry, in which case, no instructions will be presented to the operator and the calibration procedure will continue.

In the case where the signal source specified for the testoint is "Special", the Setup Instructions menu displayed is different, refer to paragraph 9.11.3.

9.10.18 Specification

The Specification against which the performance of the instrument under test at the test point is compared, can now be entered. The select box offers a choice of up to six different ways of presenting specifications.

The options are:

F1	ppmR ± ppmFS ± µV
F2	ppmR ± ppmFS
F3	ppmR ± digits
F4	%R ± %FS
F5	%R ± digits
F6	Absolute

where R = reading, FS = full scale and one digit is the value of one of the least significant digit on the display of the DMM. Selecting absolute limits will allow the entry of the specifications of the instrument in terms of a high and a low reading limit.

Any of the entries may contain 0, for instance, in this way, it is possible to enter the specification for a test point as 0%R ± 10 digits.

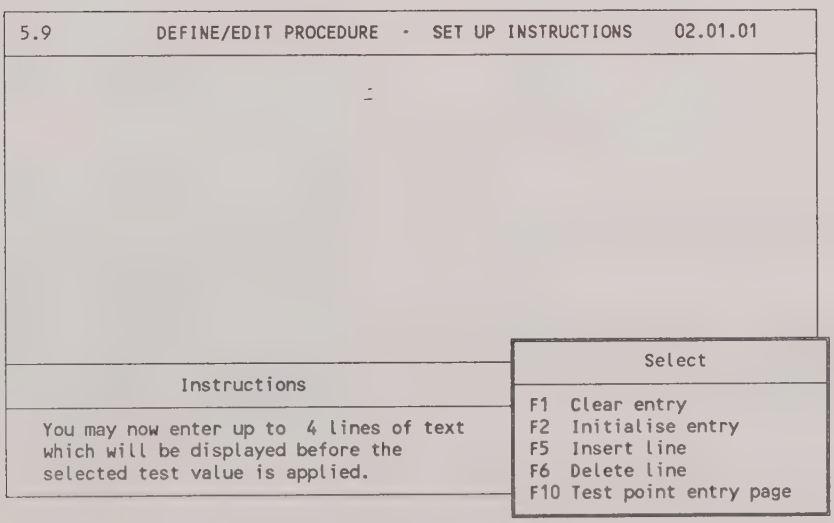

5.9 DEFINE/EDIT PROCEDURE - SET UP INSTRUCTIONS 02.01.01
Instructions
You may now enter up to 4 lines of text which will be displayed before the selected test value is applied.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Test point entry page

Fig 9.12 Define / Edit Procedure - Setup Instructions Menu

Absolute specifications are checked to ensure that the lower tolerance is lower than the applied value, and the higher tolerance is above the applied value. The exception is when the functions has been defined as Special, in which case this check is suspended.

Note that in the case of resistance calibration with absolute tolerances, where the applied value is extremely unlikely to be exactly nominal, the tolerances applied at run-time are modified to straddle the actual applied value as the tolerances applied in the procedure generator straddle the nominal value.

Selecting the format to match either the instrument's specifications as presented in its operating manual, or in its technical literature, makes the entry of specification numbers straightforward. Once selected, type in the required values, followed by the ↵ key.

9.10.19 Format

The error of the instrument under test compared with the calibrators, can be displayed in one of three different formats, both on the monitor screen during calibration and also on the calibration certificate printout. Choose the required format from the Select Box and press the ↵ key. For test values of 0, only one format, digits, is allowed, since % or ppm are then meaningless.

The error that is displayed on the screen and printed on the calibration certificate, if specified, is calculated from a mathematical formula.

For an error specified in digits, the formula is:
Reading - Nominal

For an error specified in % or ppm, the formula used is:

$$\frac{\text{Reading - Nominal}}{\text{Nominal}}$$

Therefore, for an applied value of -10.00000 V, and a reading of -10.00005 V, the calculated error in ppm is +5ppm, whereas the error expressed in digits is -5d.

9.10.20 Trigger

This entry is blanked for a manually controlled instrument. For all IEEE-488 controlled procedures, this field will appear. The entry will automatically default to the trigger as defined in the IEEE I/O menu (paragraph 9.9.9.6), but the user may wish to alter the trigger definition for this particular test point. The editing facilities available are described in paragraph 9.9.9.5.

For example, those instruments which have an automatic input zero facility may be zeroed against a test value of zero, using an input zero trigger as opposed to a normal reading trigger.

Selection of function key F1 (GET) will cause the generation of a Group Execute Trigger at the appropriate point in the procedure. Selection of function key F2 (ASCII) allows the user to define an ASCII code to be used as a trigger. Selection of the ↵ key will move the highlighted cursor on to the next prompt.

9.10.21 Delay/Discard/Average

These entries are blanked for manually controlled instruments. For all IEEE-488 controlled procedures, these entries allow for variable settling delays and other instrument synchronization facilities.

Delay defines how many seconds the system will wait after applying the test signal before triggering the DMM. Delays allowing the calibrators themselves to settle are built into the 4101B sofware, so this entry is purely to allow settling delays for the DMM measuring circuitry.

Discard defines how many readings are taken from the DMM and discarded before taking the required reading. This provides an alternative means of controlling settling periods.

Average defines how many readings after the settling period the system will take and then average in order to get a result. This is useful for noisy measurements.

The average field has one use that is not immediately obvious, which is best explained in conjunction with the calibration trigger. Refer to paragraph 9.10.24

For most situations, it will only be necessary to 'average' one reading. For difficult measurements though, the system will allow delays up to 99 seconds, the discarding of up to 99 readings, and the average of up to 99 readings.

9.10.22 Cal Precision

This entry is blanked for all calibration types other than Electronic Cal. For Electronic Cal. procedures, the system needs to know to what specification the instrument must perform immediately after the sending of a calibration trigger.

For example, the 90 day specification of the instrument may have been entered in the specification part of the menu, but it would be reasonable to expect the instrument to perform well within that specification immediately after receiving a calibration trigger.

'Cal precision' permits the user to define a specification which the instrument is required to perform to immediately after calibration as a percentage of the normal specification. Entering 50% in the above example would check the instrument's performance, immediately after reciept of the calibration trigger, against half the spec. entered in the specifications field. Select the ↵ key to continue.

9.10.23 Tries

This entry is blanked for all but Electronic Cal. types of calibration. Electronic calibration processes can be iterative. 'Tries' defines how many times the calibration trigger is to be sent by the system before the instrument either meets the required performance levels and passes, or fails to do so.

If, after the defined number of attempts, the instrument is still not within the Cal. precision percentage of specification, then the result is labelled as a 'Fail' and the procedure can be designed to either continue with the calibration procedure or abort the process.

Enter the required number of tries and press the ↵ key.

9.10.24 Cal. Trig

This entry is only present for Electronic Cal. types of procedures. Enter the necessary IEEE-488 code or command used to trigger calibration adjustment for the particular test point. The editing facilities available within this field are detailed in paragraph 9.9.9.5.

When calibrating an instrument that requires to be informed of the exact value of the applied stimulus, for example, during resistance calibration, this Cal Trigger should contain the exact numeric cal code and format as discussed in section 9.9.9.9. This number will then be replaced by the true ohms value provided by the system. If, however, the calibration does not match exactly the numeric cal code and format fields, then the contents of the calibration trigger is sent to the instrument under test unchanged.

The sequence of events during calibration is:

i) The test value is applied as applicable, with any calibrator settling delays automatically applied.

ii) The user defined delay is applied to allow the instrument under test to settle.

iiI) If the "discard" field is not 0, then the reading trigger (not the calibration trigger) is sent and a reading extracted for each discard specified. The readings extracted are discarded, and have no effect on any subsequent calculations.

iv) The specified calibration trigger is sent (modified as necessary), and any reading available from the instrument under test is extracted, and discarded. This is so that the software may cope with instruments that return a text message after successful calibration of each testpoint.

v) If the value of "average" is not 0, then that number of reading triggers are sent, and that number of readings averaged, to produce a reading for that testpoint.
If, however, the "average" field contains 0, then the software will send the contents of the reading trigger (which may be left blank), but not wait for a SRQ (if enabled) and not attempt to take the reading. The result for this testpoint, as stored in the results database and printed on the calibration certificate, will be "No Value".

Selection of the ↵ key will move the cursor to the 'Test Point if Fail' prompt.

9.10.25 Enter Adjustment Instructions

This prompt is displayed for all procedures requiring manual adjustments; IEEE-Ver/Cal, IEEE Cal, Manual Ver/Cal and Manual Cal. Selecting function key F1 (Yes) will display the Define/Edit Procedure - Adjustment Instructions page (Fig 9.13), where details of the required adjustments, at that particular test point, can be entered. The editing facilities available within this menu are described in section 5, paragrah 5.2, and the entered instructions are displayed at the appropriate time to the calibration technician when running the calibrate program.

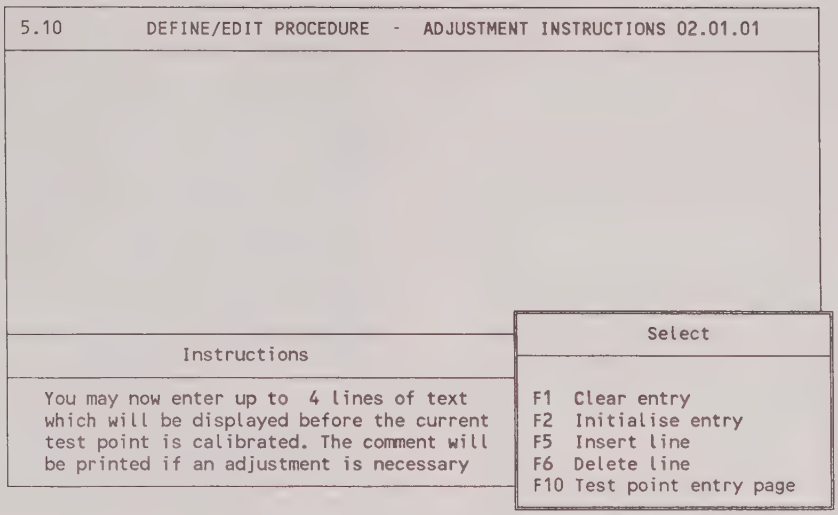

5.10 DEFINE/EDIT PROCEDURE - ADJUSTMENT INSTRUCTIONS 02.01.01
Instructions
You may now enter up to 4 lines of text which will be displayed before the current test point is calibrated. The comment will be printed if an adjustment is necessary
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Test point entry page

Fig 9.13 Define / Edit Procedure - Adjustment Instructions Menu

i) For IEEE Ver/Cal type procedures, the test stimulus is applied, any programmed delays and discards performed, the reading trigger sent and an average reading computed, if programmed. The measured value is then compared to the specifications entered for that test point, and if the measured value is found to be within borderline specification, the procedure will continue to the next test-point (refer to section 10, paragraph 10.5.3.2 for the definition of borderline). If, however, the performance of the instrument is found to be outside of borderline specification, any adjustment instructions entered will be displayed on the screen The software continuously applies the reading trigger, takes a reading and displays the reading on the screen. At this point, the operator should make any manual adjustments required and inform the system when the adjustment is complete by selecting the F10 key.

ii) The sequence of events for an IEEE Cal procedure is similar, except that no decision is made as to whether or not the instrument is within borderline performance. Any adjustment instructions entered will be displayed and readings continuously taken from the instrument under test. When adjustment is complete, the operator informs the system of this fact by selecting the F10 key.

iii) Manual Ver/Cal type procedures operate in the same way as the IEEE Ver/Cal, except that the readings are not continuously extracted from the instrument under test, but the adjusted state of the instrument is verified by prompting the operator to take a second reading.

iv) In the case of Manual Cal procedures, the system applies the test value, displays any adjustment instructions, and then, on receipt of the F10 key (Continue), will prompt the operator to take a reading.

If no adjustments are required, then selection of function key F2 (No) or the ↵ key will bypass this entry.

9.10.26 Test Point If Fail

This entry is blanked for the 'Man. Verify' and 'IEEE Verify' calibration type procedures.

If the procedure involves any form of adjustment, this provides a facility to loop back and re-adjust over a number of steps, if any particular test point fails against specification. For example, if the ohms converter of any instrument proves impossible to set up, it may be necessary to return to the DC volts function, in order to reset that before progressing on to ohms again.

Using the test point number system, the user can elect to jump to any test point in the procedure as a result of a particular failure, and then run sequentially from that destination test point. Leaving the 'Test Point if fail' set to 00.00.00.00, or to a testpoint number that does not exist, will cause the program to merely move on to the next test point in the calibration procedure sequence, if a 'Fail' is detected during a calibration run.

'Nested' jumps are allowed, to a nesting level of 10. Jumps forwards to outside of the nests are allowed, but jumps backwards to outside of the nest are not allowed.
Testpoints may not posess more than one result, so any jumps to a testpoint that has already been run (ie already posesses a result) will cause the old result to be over-written by the new result.

Type in the required Test Point Number followed by the ↵ key.

IMPORTANT NOTE: It is advised that this facility is used with care, since, if after generation of a procedure, test-points are added into or deleted from the middle of a procedure, the testpoint if fail entries are NOT re-numbered, and so do not track the change of testpoint numbers. Therefore, it is preferable to generate the procedure, and when it is complete and in its final form, then add the testpoint if fail entries as required.

9.10.27 Tries

This entry should be distinguished from the Tries field (paragraph 9.10.23) which is only applicable to Electronic Cal. procedures. This field applies to all procedures that incorporate some form of adjustment (Electronic Cal., IEEE Ver/Cal, IEEE Cal, Manual Ver/Cal and Manual Cal.), and defines the number of times that the 'test point if fail' loopback is attempted before the program decides that to try again would be pointless.

At this point, the result would be labelled as a 'Fail' and the operator would either continue with the rest of the calibration procedure or opt to abort the process.

9.10.28 Further Test Point Entry

Having completed the 'Test Point if Fail/Tries' entries, selection of the ↵ key will move the inverse video cursor to the first position in the 'Test Point' block (i.e. either 'Frequency' (if AC) or 'Enter Set Up instructions'). Repeated selection of the ↵ key will scroll the cursor down the Test Point block, allowing any corrections or alterations to be made to the entries.

If the Signal Source is ACV or ACI and the No. of frequencies permits, function key F2 (Next Test Point) will allow entry of the details for the next frequency associated with the current test value. Otherwise, selection of function key F10 (Previous block) will move the cursor to the Test Value prompt, where again the ↵ key may be used to scroll down these entries in order to make alterations. If more than one Test Value is required, for this range, then function key F2 (Next Test Value) will allow entry of details associated with the next test value.

Otherwise, selection of function key F10 (previous block) will move the cursor to the Range prompt. Again, the ↵ key may be used to scroll down this section, permitting alterations at any stage. If more than one range is required, function key F2 (Next Range) will permit entry of the details associated with the next range, and the Test Point Number will track the position within the procedure.

In this manner, all of the details on ranges, test values and test points (frequencies) may be entered for the particular function of interest. At all times the Test Point Number at the top of the display indicates exactly which part of the procedure is being entered or altered at that moment.

Where appropriate, the Select Box will provide choices allowing the user to move the 'Previous' or the 'Next' Range, Test Value, or Test Point. In addition, there are 'Insert' and 'Delete' facilities available for Ranges, Test Values and Test Points, so that the order of the calibration procedure sequence may be readily changed.

If the message "WARNING ! Editing Existing Data" is displayed on the botom line of the monitor, this indicates that any data entered here will over-write any data that was previously entered.

It is recommended that these facilities are experimented with so that the user becomes familiar with their use.

Note that when moving around this menu, the only entries which are valid on the screen are those in the same 'block', and those 'blocks' which lie above the position of the cursor. In other words, when the cursor is located over the Test Value field, selecting F2 (Next Value) causes the displayed information in that same block to be updated, but the information displayed in the lower block will not be updated until the cursor is located over that block.

9.11 Special Function /Source

9.11.1 Introduction

Special Function/Source is intended to be used when either the parameter to be checked on the instrument under test is not one of the normal functions such as DCV or Ohms, or when the required calibration source cannot be provided by the system calibrator(s).

For example, certain digital multimeters require the input bias current of their DC pre-amp to be trimmed to within certain limits as the first part of a full calibration procedure. This could entail the application of an external shielded high value resistor to the instrument switched to a certain DCV range followed by some adjustment.

In order to include peculiar tests such as that described above within a procedure, the system offers 'Special' in the Select Box when in the Define Procedure Function Menu at the Function Selection stage, or when in the Define Test Point Menu at the Signal Source selection point.

9.11.2 Special Function

If Special is selected in the Function column, the only effect that it has on the following prompts and menus is that all restrictions (such as only permitting the entry of a test value that is lower than the full scale value entered) are suspended. The following checks are disabled when defining a Special Function, but still using the system Calibrator(s) as the stimulus source(s):

i) The check to ensure that the Test Value applied is less that the Full Scale Value for that range.

ii) With DCV and DCI functions, the absence of the +/- sign on the front of the Full Scale Value prevents a negative test value being programmed. In Special Function, this check is suspended.

iii) In all other functions, the test value entered is formatted to be in the same format, with the same number of digits as the Full Scale Value entered. In Special Function, this formatting is inhibited.

iv) In all other functions, the AC voltage output is limited to a Volts-Hertz product of 2 X 10E7, due to the losses in the standard lead kit. In Special Function, this check is suspended so that through the use of a suitable lead setup, the full capabilities of the system calibrator(s) may be utilized.

v) In all other functions, when entering absolute specifications for each testpoint, the specifications are checked to ensure that a) the higher specification is higher than the lower specification and b) that they both straddle the test value. In Special Function, the specifications may only be entered in absolute terms, and this check is inhibited.

Special Function may also serve to identify that the particular tests of interest would not normally be associated with the usual functions (DCV, ACV, etc.).

9.11.3 Special Source

If Special is selected as a Signal Source then the system recognises that its calibrators will not be required as the calibration source for the test carried out on that function. As mentioned earlier, the calibrator(s) are turned into the OFF state, and control passes to the front panel buttons.

So, for instance, it is possible to instruct the operator to connect an alternative calibration source (such as a standard resistor or a decade resistance box) to the unit under test.

When Special Source is selected, the field Signal Source Range in the Define Test Point Entry Menu is replaced by a prompt: Measurement Mode, as in Fig 9.14.

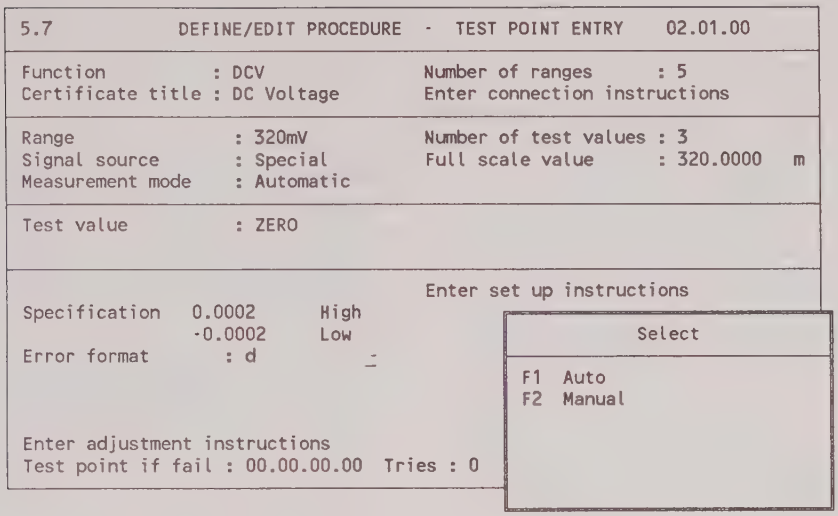

5.7 DEFINE/EDIT PROCEDURE - TEST POINT ENTRY 02.01.00
Function : DCV
Certificate title : DC Voltage
Number of ranges : 5
Enter connection instructions
Range : 320mV
Signal source : Special
Measurement mode : Automatic
Number of test values : 3
Full scale value : 320.0000 m
Test value : ZERO
Enter set up instructions
Specification 0.0002 High
-0.0002 Low
Error format : d
Enter adjustment instructions
Test point if fail : 00.00.00.00 Tries : 0
Select
F1 Auto
F2 Manual

Fig 9.14 Test Point Entry Menu - Special Source

9.11.4 Measurement Mode

The Select Box offers F1 (Auto) and F2 (Manual) for the Measurement Mode prompt. The significance of the data entered here varies between the different types of calibration procedure.

i) Electronic Cal. type procedures: 'Auto' is offered for those situations where the calibration source is external to the system, but the system is still expected to provide a calibration trigger and also to read the results back from the instrument under test over the IEEE-488 interface.

ii) IEEE-488 type procedures: 'Auto' is offered for those situations where the calibration source is external to the system, but the system is still expected to read the result from the instrument under test from the IEEE-488 interface.

iii) Manual type procedures: alternatively, if the instrument is manually controlled, 'Auto' may be selected to allow an operator to type in a result, typically the reading on the display of the instrument under test, which will then be compared by the system against the entered specification.

iv) All Instruments: 'Manual' is offered for the situation where the source (if any) is external to the system and it is inappropriate or impossible for the system to take readings from the instrument under test. The operator running the Calibrate program will get the opportunity to key in a comment or reading and indicate whether this is a Pass or Fail result. A typical situation in which Manual measurement mode could be used is in a test verifying the operation of an instrument's continuity beeper.

In all situations, set up and adjustment instructions can be given to guide the operator through such tests.

There are two points worth noting:

i) That the Define Procedure Set Up Instructions Menu when Special Source is selected, has two text areas, as in Fig 9.15: Set Up instructions (displayed first) and Source Connect instructions (displayed second), to ensure that the instrument is correctly set up before the calibration source is connected. The editing functions available within this menu are described in section 5, paragraph 5.2.

ii) It is not possible for the system to control, via the IEEE-488 bus, any calibration source external to the system using the 4101B system software.

9.12 Editing Procedures

9.12.1 Introduction

Apart from creating new procedures, the Define/ Edit Procedure program is also used to edit existing procedures. This may be done either to correct mistakes in procedures or to generate similar but different procedures from an existing procedure.

Because of the temporary file approach employed with the system the original procedure is not lost when it is edited. The original procedure will only be lost if it is overwritten (using Save Procedure) or deleted (using Delete Procedure).

9.12.2 Recommendation

It is recommended that the user becomes familiar with the Recall Procedure, Save Procedure, Print Procedure and Define Procedure sections before attempting to edit procedures.

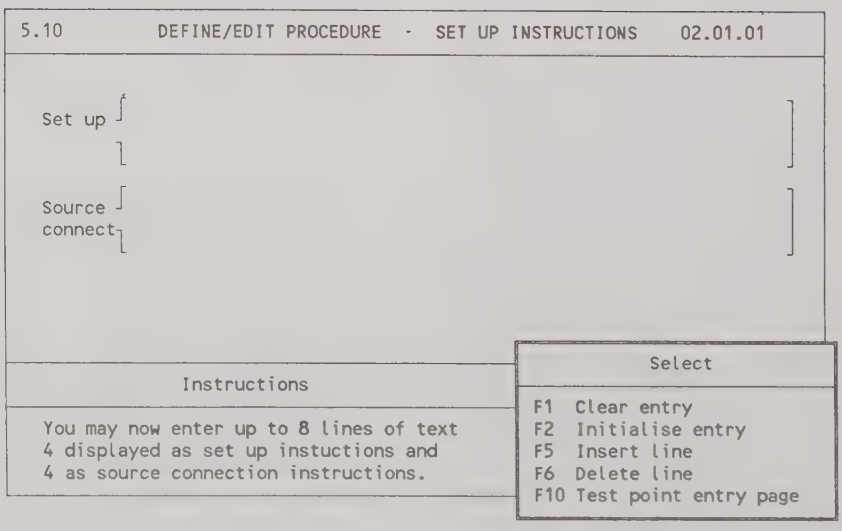

5.10 DEFINE/EDIT PROCEDURE - SET UP INSTRUCTIONS 02.01.01
Set up
Source connect
Instructions
You may now enter up to 8 lines of text
4 displayed as set up instuctions and
4 as source connection instructions.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Test point entry page

Fig 9.15 Define / Edit Procedure - Setup Instructions Menu (Special Source)

9.12.3 Operation

The general approach is very straightforward:

i) Use the Recall Procedure Program to load the procedure to be edited into the temporary file.

ii) It may be useful at this point to use the Print Procedure Program to obtain a print out of all the parameters and text used in the original procedure. The planned changes can then be made on paper prior to using the edit facilities.

iii) With the recalled procedure in the temporary file, go into the Define/Edit Procedure Menu (Fig 9.6) and select function key F1 (Continue with current procedure) to ensure that the temporary file retains the details of the recalled procedure.

iv) The Define/Edit Procedure - Function Menu (Fig 9.7) will be displayed with all the details of the original recalled procedure. Using the various function keys and the ↵ key, the highlighted cursor may be moved to any part of any of the Procedure Generator Menus allowing the original entries to be changed if required.
For editing a particular test point, the Test Point Number at the top of the Define/Edit Procedure - Function Menu (Fig 9.7) and the Define/Edit Procedure - Test Point Entry page (Fig 9.10) will always identify which test point details are currently being displayed.
Note that it is not possible to change a procedure from a Manual procedure (Manual Ver/Cal, Manual Cal or Manual Verify) to an IEEE type procedure (IEEE Ver/Cal, IEEE Cal, or IEEE Verify). In addition, and Electronic Cal type procedure cannot be changed to any other type, and other types cannot be changed to an Electronic Cal. type.

v) When the alterations are complete, the Print Procedure Program may be used again to list out all the parameters and text associated with the edited procedure so that they may be checked.

vi) If all looks to be correct the Save Procedure Program can be used to copy the edited procedure into the Procedure Files for more permanent storage.

9.13 Testing Procedures

9.13.1 Introduction

Having saved the procedure and checked that its print out of parameters seem correct, the next stage is to test the procedure using the Calibrate Program.

9.13.2 Operation

For a more comprehensive description, refer to section 7 for details of the calibrate program. The general principle is described here.

i) From the System Menu (Fig 9.1), select function key F1 (Calibrate) in order to display the Calibrate Menu (Fig 9.16). Enter the details of the instrument to be tested as described and call up the procedure to be tested when the Procedure Numbers prompt is reached.

ii) The objective is to run the procedure exactly as the operator would run it in the future. This test run can either be carried out at normal speed, which may be quite fast if it is a totally automatic procedure, or a single test point at a time with the user selecting a function key to move on to the next test point.

The Continuous (normal speed) or Step (line by line) modes may be set up using the Edit/Test Procedure facility in the Calibrate Program.

iii) Two aids for debugging a procedure exist: Firstly, the IEEE debug mode may be entered by selecting Shift F10 as opposed F10 when initiating the procedure run. Secondly, the Real Time Print Function may be used to print out the result of each testpoint as it executes. Both of these facilities may be used simultaneously, if required.

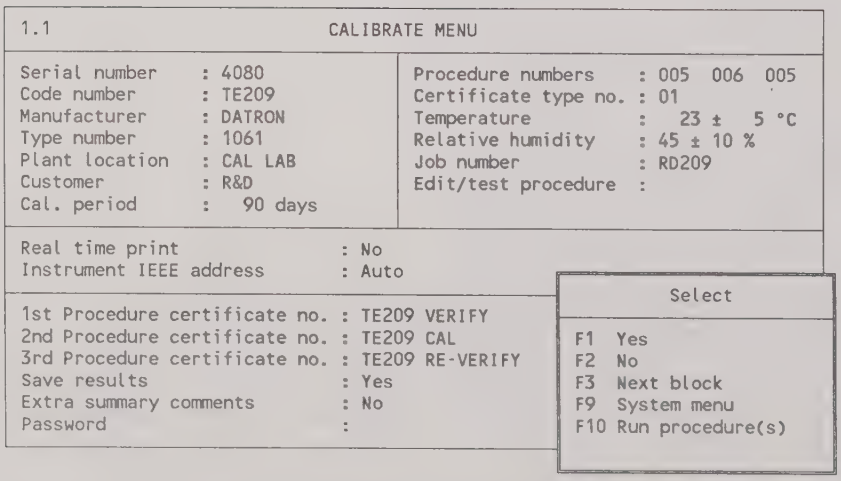

1.1
CALIBRATE MENU
Serial number : 4080
Code number : TE209
Manufacturer : DATRON
Type number : 1061
Plant location : CAL LAB
Customer : R&D
Cal. period : 90 days
Procedure numbers : 005 006 005
Certificate type no. : 01
Temperature : 23 ± 5 °C
Relative humidity : 45 ± 10 %
Job number : RD209
Edit/test procedure :
Real time print : No
Instrument IEEE address : Auto
1st Procedure certificate no. : TE209 VERIFY
2nd Procedure certificate no. : TE209 CAL
3rd Procedure certificate no. : TE209 RE-VERIFY
Save results : Yes
Extra summary comments : No
Password :
Select
F1 Yes
F2 No
F3 Next block
F9 System menu
F10 Run procedure(s)

Fig 9.16 Calibrate Menu

9.14 Print Procedure

9.14.1 Introduction

A comprehensive printout of all the parameters, values and text entered into a procedure is an invaluable aid for debugging and can also act as a Quality Assurance document for an approved procedure. The printed procedure is the one that is held in the temporary procedure file, otherwise known as procedure 000. It may be necessary to recall the procedure required before it may be printed.

9.14.2 Operation

Selecting function key F4 (Print Procedure) on the Procedure Generator Menu (Fig 9.2) will cause the printout to begin. Because of the amount of detail associated with a typical procedure, this activity may take several minutes. At any time function key F6 (Abort) can be used to abort the process.

9.15 Print Library

9.15.1 Introduction

A printout which lists all of the procedures currently held in the Procedure Library can sometimes be easier to use than scanning through page after page on the monitor screen.

9.15.2 Operation

Selecting function key F6 (Print Library) on the Procedure Generator Menu will cause the library of procedures to be listed.

9.16 Transfer of Procedures Between Systems.

9.16.1 Introduction

Procedures may be created on one controller and then transferred (via either the RS-232 interface, or using a floppy disk) to other controllers also running the 4101B software. This facility allows the 4101B software to be used 'offline' to create procedures which can then be transferred to the working, calibrating system. In addition, this is a simple method of creating a temporary backup of a procedure, although it is no substitute for performing regular, full backups.

9.16.2 Send Procedure

9.16.2.1 Introduction

The Send Procedure Menu (Fig 9.17) allows the user to look through the library of procedures, select a procedure, and transfer it either to the hard disk or to a floppy disk (possibly to take it to another Portocal system), or send it via an RS-232C data communications link to another Portocal system. Selection of function key F8 (Send Procedure) from the Procedure Generator Menu will display the Send Procedure Menu.

9.16.2.2 Send Procedure Number

Function key F1 (Next Page) will allow paging through the procedure library, while function key F2 (Page Select) allows the entry of a procedure start number which will then display the page of 20 procedures following the start number entered. Enter the number of the procedure required for transfer followed by the ↵ key.

9.16.2.3 Transfer Medium

The select box offers the choice of transferring the procedure to hard or floppy disk (F1), or to the RS-232C communications port (F2).

9.16.2.3.1 Transfer to Disk

If transfer to disk was selected, then an additional prompt is provided:

Drive: \ Path \ Filename

This allows the user to specify which drive and under what directory and file name labels the data is sent to.
An understanding of DOS would help the user to make use of this facility.

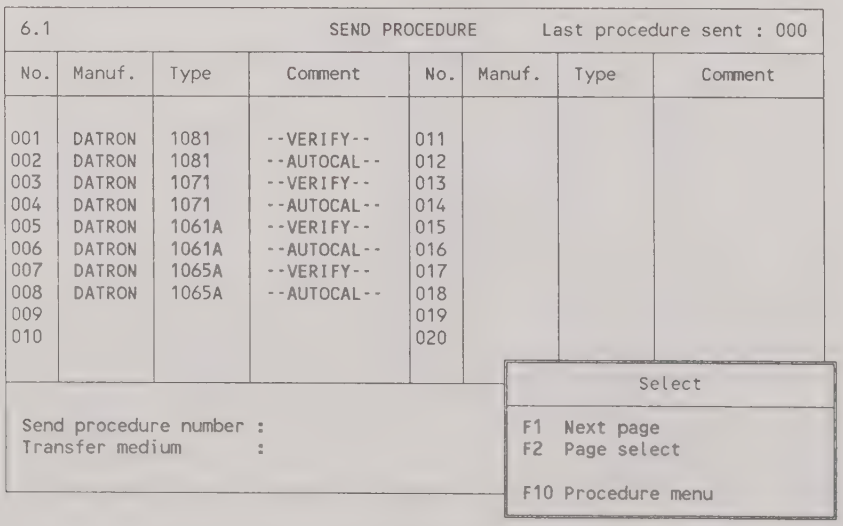


Fig 9.17 Send Procedure Menu

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the procedure to the C drive (the hard disk) into a series of 8 files called ABC.$$1, ABC.$$2, etc up to ABC.$$8, held in a sub-directory called XYZ. Note that the file extensions are fixed and may not be changed.

C:\ABC will transfer the procedure to the C drive into a series of 8 files called ABC.$$1, ABC.$$2 etc up to ABC.$$8 under the main (root) directory.

A:\ABC will transfer the procedure to the root directory of the floppy disk (drive A) into a series of 8 files called ABC.$$1, ABC.$$2, up to ABC.$$8.

ABC will copy the procedure to the default drive (drive C - hard disk), under the existing directory (PORTOCAL), with file names of ABC.$$1 to ABC.$$8

XYZ\ABC will copy the procedure to the default drive (drive C - hard disk), under a sub-directory XYZ beneath the PORTOCAL directory, in a series of files named ABC.$$1 to ABC.$$8

When the Drive: \ Path \ Filename parameter has been entered, select F3 for Send Procedure and the transfer process will begin.

The Portocal software does not check for the validity of the entered Drive: \ Path \ Filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, display a suitable error message (typically "Path not found"), abort the requested transfer and force the Procedure Generator menu (Fig 9.2).

9.16.2.3.2 Send to RS-232

If, at the Transfer Medium prompt, the F2 for RS-232C is selected, then the system prepares to send the procedure to another Portocal system via the RS-232C communications port. No other parameters are required, and the selection of F3 (Send Procedure) will initiate the transfer.

(It does not matter when sending procedures via the RS-232C interface whether the receiver is activated before the sender or vice versa. Both will wait until they are both ready before transmission occurs.)

9.16.3 Receive Procedure

9.16.3.1 Introduction

The Receive Procedure Menu allows the user to receive a procedure from a) files placed on a floppy disk or hard disk by the Send Procedure function or b) another Portocal system via the RS-232C interface and store it anywhere within the procedure library. Selection of function key F7 (Receive Procedure) from the Procedure Generator menu (Fig 9.2) will cause a cursor to flash against the password prompt. Correct entry of the Procedure/Certificate password followed by the ↵ key will display the Receive Procedure Menu, Fig 9.18

9.16.3.2 Receive Procedure Number

Function key F1 (Next Page) will allow paging through the procedure library, while function key F2 (Page Select) allows the entry of a procedure start number which will then display the page of 20 procedures following the start number entered. Enter the Procedure number where the transferred procedure is to be stored and depress the ↵ key.

9.16.3.3 Transfer Medium

The select box offers the choice of transferring the procedure from hard or floppy disk, (F1) or from the RS-232C communciations port (F2).

9.16.3.3.1 Transfer from Disk

If transfer from disk was selected, then an addiional prompt is provided:

Drive: \ Path \ Filename

This allows the user to specify which drive and under what directory and file name labels the procedure is stored in.
An understanding of DOS would help the user to make use of this facility.

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the procedure from the C drive (the hard disk), from a series of 8 files called ABC.$$1, ABC.$$2, etc up to ABC.$$8, held in a sub-directory called XYZ. Note that the file extensions are fixed and may not be changed.

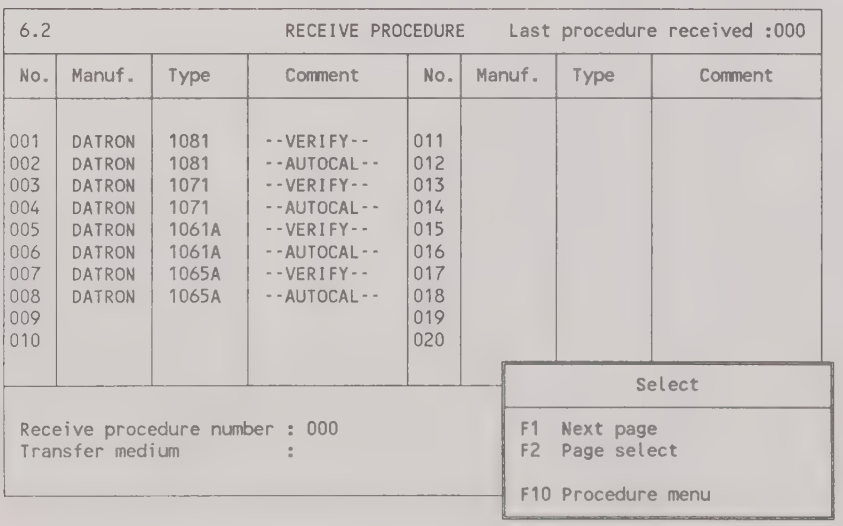


Fig 9.18 Receive Procedure Menu

C:\ABC will transfer the procedure from the C drive, from a series of 8 files called ABC.$$1, ABC.$$2 etc up to ABC.$$8 under the main (root) directory.

A:\ABC will transfer the procedure from the root directory of the floppy disk (drive A), from a series of 8 files called ABC.$$1, ABC.$$2, up to ABC.$$8.

ABC will copy the procedure from the default drive (drive C - hard disk), under the existing directory (PORTOCAL), from file names of ABC.$$1 to ABC.$$8

XYZ\ABC will copy the procedure from the default drive (drive C - hard disk), under a sub-directory XYZ beneath the PORTOCAL directory, from a series of files named ABC.$$1 to ABC.$$8

When the Drive: \ Path \ Filename parameter has been entered, select F3 for Receive Procedure and the transfer process will begin.
The Portocal software does not check for the validity of the entered Drive: \ Path \ Filename parameter. If, however, an error is detected by DOS, the 4101B software will detect this condition, display a suitable error message (typically "Path not found" or "File not found"), abort the requested transfer and force the Procedure Generator menu (Fig 9.2).

9.16.3.3.2 RS-232 port

If function key F2 is selected, then the system prepares to receive the procedure via the RS-232C communications port from another Portocal system. No other parameters are necessary, and selection of F3 (Receive Procedure) will initiate the requested transfer

(It does not matter when sending procedures via the RS-232C interface whether the receiver is activated before the sender or vice versa. Both will wait until they are both ready before transmission occurs.)

SECTION 10: THE CERTIFICATE GENERATOR

10.1 Introduction

The Calibrate program and the Recall Results program may both print out results in the form of a calibration certificate. The full Portocal System calibration certificate consists of two basic page formats: a title page which contains a description of the instrument being calibrated and the general conditions surrounding that calibration, which is followed by multiple results pages where all the results are tabulated.

The Certificate Generator may be used to alter the text appearing on the calibration certificate. For example, the headings at each page of the certificate can be made to print out the user's company identity. In this way, the standard system calibration certificate can be amended to reflect the kind of terminology which is specific to a particular user. Note, however, that the format of the "results only" certificate printout (refer to section 7, paragraph 7.4.2.2 and section 8, paragraph 8.6.1) is fixed and cannot be modified by the user.

In addition, the data displayed in the Calibration in Progress menu (refer to section 7, paragraph 7.3), and the format in which that data appears, may be customized.

Up to 20 different certificate types may be designed and saved on disk, each certificate being the same in general layout format, but with different text.

The Define Title Page and Define Results Page sections of the Certificate Generator Menu break down the standard calibration certificate into various different sections, which may be individually altered or edited to suit the customer's requirements.

10.1.1 'Master Certificates'

Two certificates are supplied with the 4101B software; Master IEEE and Master Man. The first is a standard format certificate for IEEE-488 based instruments, the second for manually controlled instruments. These provide ideal building blocks for designing custom certificates for specific applications.

The Master IEEE certificate causes the Calibration in Progress menu, the Calibration Certificate Results pages and the Recall - Review Results menu to display calibration results in the order, from left to right: Range, Test Value, Frequency, Indicated Value.

However, as results are taken from a manually controlled instrument by adjusting the output of the calibrator so that the instrument under test displays the nominal test value, the Master Man certificate causes calibration results to be displayed in a different order. When the current certificate is a 'Manual' certificate, the Calibration in Progress menu, the Calibration Certificate Results pages and the Recall - Review Results menu to display calibration results in the order, from left to right: Range, Indicated Value, Frequency, Test Value.

10.2 Operation

Selecting function key F4 (Certificate Generator Menu) from the Portocal System Menu (Fig 10.1), will display the Certificate Generator Menu (Fig 10.2).

Before a certificate format may be edited, reviewed or printed, it must first be recalled from the Certificate Library and placed in a temporary file, otherwise known as certificate number 00. Any changes made to this certificate are stored on the disk, but will not be written into the certificate library (and thus be usable by the Calibrate and Recall programs) until the temporary file has been saved into the Certificate Library (performed by the "Save Certificate" program).

The Current Certificate line at the head of the Certificate Generator menu (Fig 10.2) identifies the certificate that is held in the temporary file. In the case of a Certificate Library that has not had a certificate format recalled, the current certificate will be titled "00 Default.". Below Current Certificate are listed the six major functions available on the Certificate Generator menu:

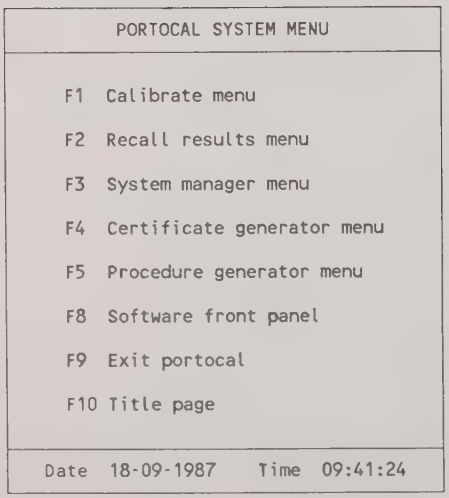


Fig 10.1 Portocal System Menu

F1 Recall Certificate: This section of the Certificate Generator allows the user to view the locations and titles of each of the certificates stored in the library, and recall any one into the temporary file, otherwise known as certificate number 00.

F2 Define Title Page: The Define Title Page section allows the user to define what information, and in what format that information will be printed on the title page of any calibration certificate printed in this format.

F3 Define Results Page: The Define Results Page section allows the user to define what information, and in what format that information will be printed on the results pages of any calibration certificate printed in this format.

F4 Save Certificate: The Save Certificate section will place the certificate format held in the temporary file, otherwise known as certificate number 00, into the Certificate Library, so that that certificate format may be used by the calibrate and recall programs.

F5 Delete Certificate: The Delete Certificate facility allows the deletion of an obselete certificate format from the Certificate Library.

F6 Print Certificate: The Print Certificate faciltiy allows the printout of the certificate format currently held in the temporary file, otherwise known as certificate number 00.

```
4.0    CERTIFICATE GENERATOR MENU  v1.00

Current certificate : 00  DEFAULT
Password            :

      F1   Recall certificate
      F2   Define/Edit title page menu
      F3   Define/Edit results page menu
      F4   Save certificate
      F5   Delete certificate
      F6   Print certificate
      F7   Receive certificate
      F8   Send certificate
      F10  System menu
```

Fig 10.2 Certificate Generator Menu

10.3 Recall Certificate

10.3.1 Introduction

Selecting function key F1 (Recall Certificate) from the Certificate Generator Menu (Fig 10.2) will display the Recall Certificate Menu (Fig 10.3). This will show a page listing up to a maximum of 20 certificates which have been already defined and stored on disk.

10.3.2 Operation

In order to recall a certificate into the temporary file, so that it may be edited or renumbered, merely type in the certificate number, press the ↵ key and select function key F1 (Recall Certificate). The message "Certificate recalled successfully" indicates that the chosen certificate format is resident in the temporary file, and ready to be edited. Select function key F10, and the Certificate Generator Menu (Fig 10.2) will return to the screen.

```
4.3                    RECALL CERTIFICATE

Type | Comment          | Type | Comment
-----+------------------+------+--------
 1   | MASTER IEEE      | 11   |
 2   | MASTER MAN       | 12   |
 3   |                  | 13   |
 4   |                  | 14   |
 5   |                  | 15   |
 6   |                  | 16   |
 7   |                  | 17   |
 8   |                  | 18   |
 9   |                  | 19   |
10   |                  | 20   |

                                  Select
Recall certificate   : 00

                                  F10 Certificate generator menu
```

Fig 10.3 Certificate Generator - Recall Certificate Menu

10.4 Define/Edit Title Page

10.4.1 Introduction

This program breaks down the title page of the certificate held in the temporary file into several sections. Each of these sections may be edited in turn, in order to create a custom designed certificate title page.

10.4.2 Operation

Selecting function key F2 (Define/Edit Title Page menu) from the Certificate Generator Menu (Fig 10.2), will cause the Edit existing / Initialize New menu (Fig 10.4) to appear. If there are details of a certificate held in the temporary file which require changing or editing, then selection of function key F1 (Continue with current certificate) will ensure that the certificate generator continues to work with that certificate's details.

If a totally new certificate is to be defined, then selection of function key F2 (Initialise certificate) will load the standard Portocal system calibration certificate into the temporary file, ready for editing. Note that selecting the Initialize option will initialize the whole certificate, not just the Title Page section.

Selection of either of these function keys will result in the Define/Edit Title Page Menu (Fig 10.5) being displayed. This partitions the title page of the certificate into six different areas, each of which may be accessed through use of function keys and individual menus.

Within these menus, the function keys provide Clear entry (F1) and Initialise entry (F2) facilities, while function key F4 (Next entry) moves the inverse video cursor around the menu (if applicable), so that the different sections of the page headings may be edited.
In the menus that operate on text fields of more than one line, F5 (Insert Line) and F6 (Delete Line) and offered. In addition, full text editing facilties, as described in section 5, paragraph 5.2 are available.

The only one of the function key facilities which is not obvious is Initialise Entry. This function causes the contents of the current field to be overwritten by the contents of the corresponding field in the equivalent of the unmodified Master IEEE/ Master Man certificates.

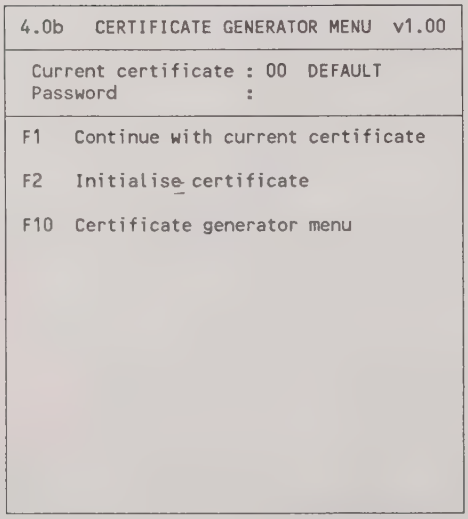

4.0b CERTIFICATE GENERATOR MENU v1.00
Current certificate : 00 DEFAULT
Password :
F1 Continue with current certificate
F2 Initialise certificate
F10 Certificate generator menu

Fig 10.4 Edit Existing / Initialize New Menu

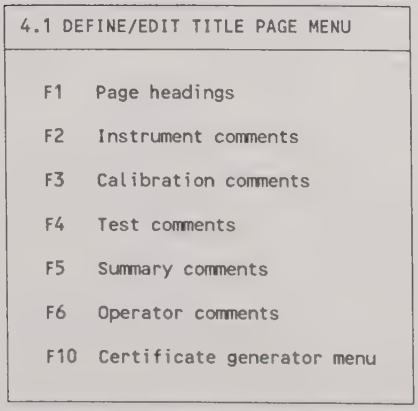


Fig 10.5 Define / Edit Title Page Menu

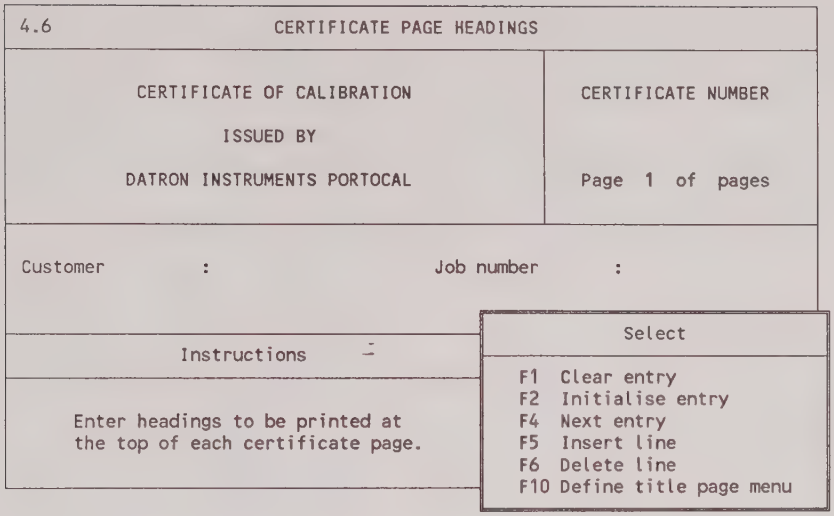


Fig 10.6 Certificate Page Headings Menu

10.4.3 Certificate Page Headings

Selecting function key F1 (Page Headings) will display the Certificate Page Headings Menu (Fig 10.6). The headings shown in this menu appear at the top of each page of the full calibration certificate.

Select function key F10 to redisplay the Define/ Edit Title Page Menu (fig 10.5)

10.4.4 Certificate Instrument Comments

Selecting function key F2 (Instrument Comments) from the Define / Edit Title Page Menu (Fig 10.5) will display the Certificate Instrument Comments Menu.(Fig 10.7) All of the items on this page may be edited or deleted, any changes being reflected in the full calibration certificate printout. For example the phrase 'Code number' could be changed to 'Asset number' or 'Plant number', depending on the terminology used within the company.

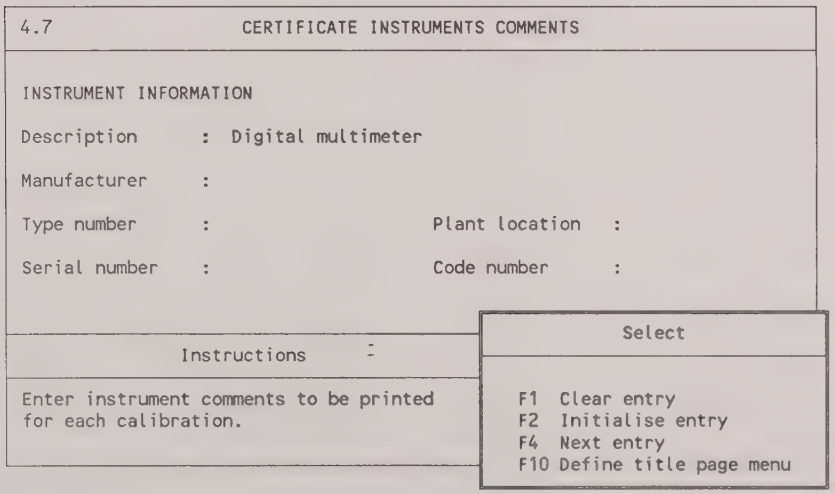


Fig 10.7 Certificate Instrument Comments Menu

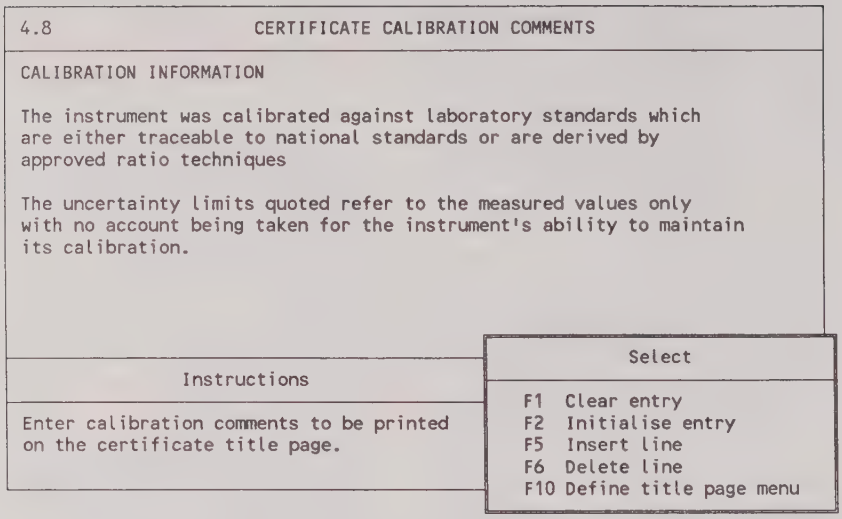

4.8 CERTIFICATE CALIBRATION COMMENTS
CALIBRATION INFORMATION
The instrument was calibrated against laboratory standards which are either traceable to national standards or are derived by approved ratio techniques
The uncertainty limits quoted refer to the measured values only with no account being taken for the instrument's ability to maintain its calibration.
Instructions
Enter calibration comments to be printed on the certificate title page.
Select
F1 Clear entry
F2 Initialise entry
F5 Insert line
F6 Delete line
F10 Define title page menu

Fig 10.8 Certificate Calibration Comments Menu

10.4.5 Certificate Calibration Comments

Selecting function key F3 (Calibration Comments) on the Title Page Menu will display the Certificate Calibration Comments menu (Fig 10.8). The text displayed on this page may be deleted or edited, as required.

Select function key F10 to redisplay the Define/ Edit Title Page Menu (fig 10.5)

10.4.6 Certificate Test Comments

Selecting function key F4 (Test Comments) from the Define Title Page Menu (Fig 10.5) will display the Certificate Test Comments Menu (Fig 10.9), where any of the details may be edited.

Select function key F10 to redisplay the Define/ Edit Title Page Menu (fig 10.5)

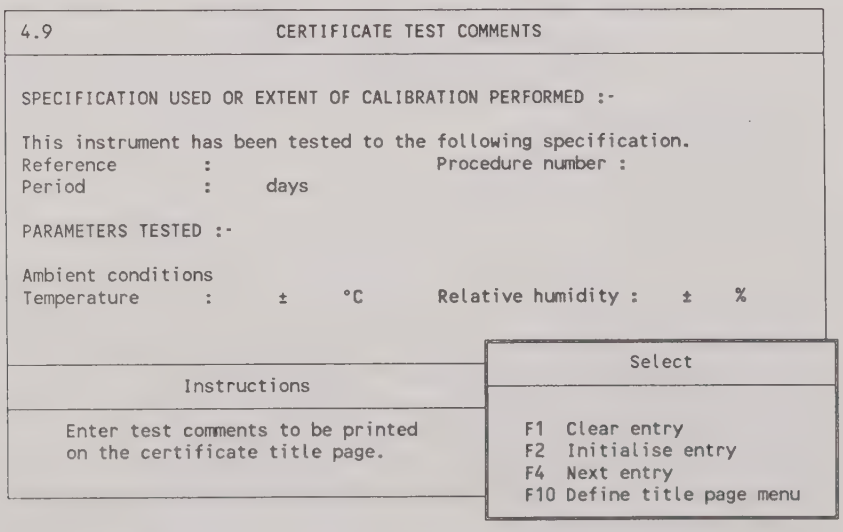

4.9 CERTIFICATE TEST COMMENTS
SPECIFICATION USED OR EXTENT OF CALIBRATION PERFORMED :-
This instrument has been tested to the following specification.
Reference : Procedure number :
Period : days
PARAMETERS TESTED :-
Ambient conditions
Temperature : ± °C Relative humidity : ± %
Instructions
Enter test comments to be printed on the certificate title page.
Select
F1 Clear entry
F2 Initialise entry
F4 Next entry
F10 Define title page menu

Fig 10.9 Certificate Test Comments Menu

10.4.7 Certificate Summary Comments

Selecting function key F5 (Summary Comments) on the Define/Edit Title Page Menu (Fig 10.5) will cause the Certificate Summary Comments (Fig 10.10) to be displayed.

When a set of results is taken, using the calibrate program, they will either have been taken as pre-adjustment readings, post-adjustment readings or readings at the time of adjustment. Furthermore, some of these readings may have failed, have been noisy, or have exceeded a borderline specification point. The Calibrate and Recall programs make a decision, at the time of printing a calibration certificate, which of these comments should be printed on the certificate.

i) The comment in position 1 ("This certificate records the pre-adjustment calibration status" in the default certificate), will appear if the calibration procedure run was defined, in the Calibrate Menu (refer to section 7, paragraph 7.1.2.16), as being a pre-adjustment verification (for IEEE Verify and Manual Verify procedure types only, refer to section 9, paragraph 9.9.6).

ii) The comment in position 2 ("This certificate records the calibration status at adjustment" in the default certificate), will appear if the calibration procedure run is one of either; Electronic Cal, IEEE Cal, IEEE Ver/Cal, Manual Cal or Manual Verify/Cal (refer to section 9, paragraph 9.9.6)

iii) The comment in position 3 ("This certificate records the post-adjustment calibration status" in the default certificate), will appear if the calibration procedure run was defined, in the Calibrate Menu (refer to section 7, paragraph 7.1.2.16), as being a post- adjustment verification (for IEEE Verify and Manual Verify procedure types only, refer to section 9, paragraph 9.9.6).

iv) The comment in position 4 ("Point where error exceeds 70% of specification are marked Bord" in the default certificate), will appear if any of the recorded results are borderline (refer to paragraph 10.5.3.2).

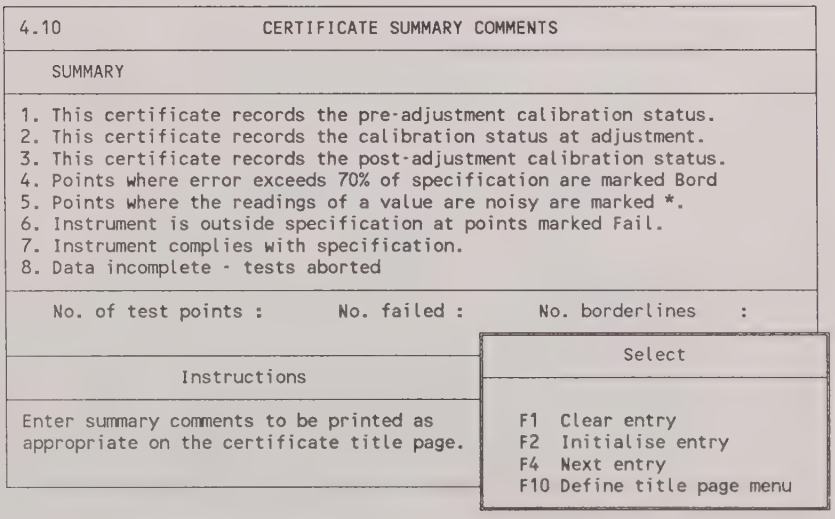

4.10 CERTIFICATE SUMMARY COMMENTS
SUMMARY
1. This certificate records the pre-adjustment calibration status.
2. This certificate records the calibration status at adjustment.
3. This certificate records the post-adjustment calibration status.
4. Points where error exceeds 70% of specification are marked Bord
5. Points where the readings of a value are noisy are marked *.
6. Instrument is outside specification at points marked Fail.
7. Instrument complies with specification.
8. Data incomplete - tests aborted
No. of test points :
No. failed :
No. borderlines :
Instructions
Enter summary comments to be printed as appropriate on the certificate title page.
Select
F1 Clear entry
F2 Initialise entry
F4 Next entry
F10 Define title page menu

Fig 10.10 Certificate Summary Comments Menu

v) The comment in position 5 ("Points where the readings of a value are noisy are marked *" in the default certificate), will appear if any of the recorded results were 'noisy'. If more than one reading was averaged to obtain the result (refer to section 9, paragraph 9.10.21) and the average indicates that the result is a pass, but one or more of the readings taken was a failure (outside of specification), then the result is defined as being noisy.

vi) The comment in position 6 ("Instrument is outside specification at points marked Fail" in the default certificate), will appear if any of the recorded results were outside of specification.

vii) The comment in position 7 ("Instrument complies with specification" in the default certificate), will appear if none of the recorded results were outside of specification.

viii) The comment in position 8 ("Data incomplete - tests aborted" in the default certificate), will appear if the procedure was aborted at run time.

More than one of the above comments may be printed on a calibration certificate, if applicable.

Select function key F10 to redisplay the Define/ Edit Title Page Menu (fig 10.5)

10.4.8 Certificate Title Page - Operator Comments

Selection of function key F6 (Operator Comments) on the Define/Edit Title Page Menu (Fig 10.5) will display the Certificate Title Page - Operator Comments (Fig 10.11), where any of the operator comments may be edited as required.

Select function key F10 to redisplay the Define/ Edit Title Page Menu (fig 10.5)

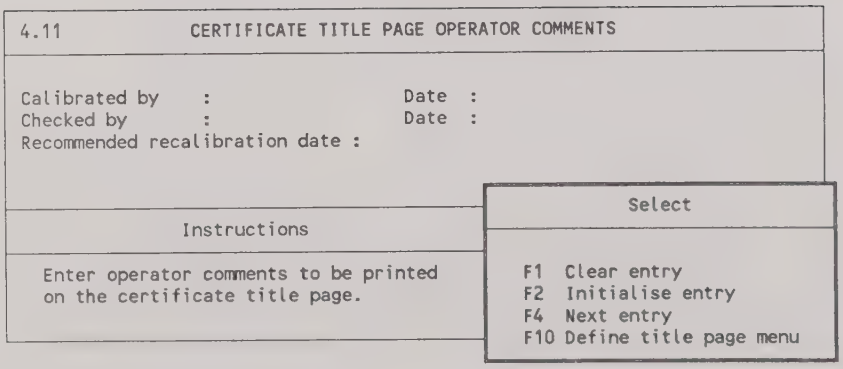


Fig 10.11 Certificate Operator Comments Menu

10.5 Define / Edit Results Page

10.5.1 Introduction

As with the Define/Edit Title Page Menu, the results page may also be broken down into various sections which can be edited using the Define/Edit Results Page Menu. In particular, this menu may be used to define the columns of information displayed on the results page and may also be used to redefine the Portocal system uncertainties which are optionally printed out at the foot of each calibration certificate results page.

10.5.2 Operation

Selecting function key F3 (Define/Edit Title Page menu) from the Certificate Generator Menu (Fig 10.2), will cause the Edit existing / Initialize New menu (Fig 10.4) to appear. Selection of function key F1 (Continue with current certificate) will ensure that the certificate generator continues to work with the certificate details currently held in the temporary file. Selection of function key F2 (Initialize certificate) will load the standard Portocal system calibration certificate into the temporary file, ready for editing. Note that selecting the Initialize option will initialize the whole certificate, not just the Results Page section.

Selection of either of these function keys will result in the Define/Edit Results Page Menu (Fig 10.12) being displayed. This partitions the results page of the certificate into eight different areas, each of which may be accessed through use of function keys and individual menus.

Within these menus, the function keys provide Clear entry (F1) and Initialise entry (F2) facilities, while function key F4 (Next entry) moves the inverse video cursor around the menu (if applicable), so that the different sections of the results page may be edited.
In the menus that operate on text fields of more than one line, F5 (Insert Line) and F6 (Delete Line) and offered. In addition, full text editing facilties, as described in section 5, paragraph 5.2 are available.

The only one of the function key facilities which is not obvious is Initialise Entry. This function causes the contents of the current field to be overwritten by the contents of the corresponding field in the equivalent of the unmodified Master IEEE/ Master Man certificates.

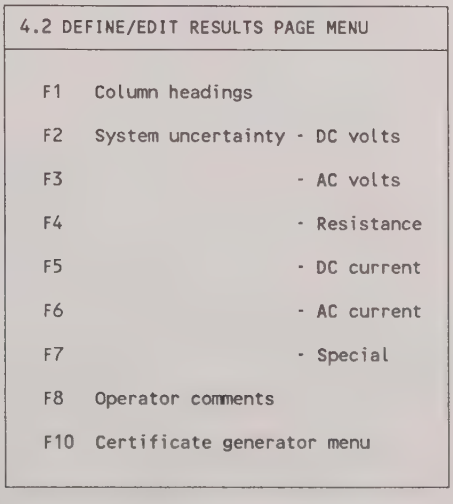


Fig 10.12 Define / Edit Results Page Menu

10.5.3 Column Headings

Selecting function key F1 (Column Headings) in the Define/Edit Results Page Menu (Fig 10.12) will display the Certificate Column Headings menu (Fig 10.13). This lists the headings which appear at the top of each certificate results page and also on the Calibration in Progress display when running the Calibrate program (refer to section 7, paragraph 7.3).

The first entry, Calibration Results, and the headings of the first four collumns (Range, Test Value, Freq (Hz) and Indicated Value) may be edited. The data that is actually displayed in these collumns varies between 'IEEE' and 'Manual' certificates (refer to paragraph 10.1.1), but is otherwise fixed.

The next three collumns (Spec. Tol., Error and % Error of Spec.in the default certificate) are all mathematically derived by the system from the results taken during a calibration run. When the current field is Spec. Tol., the Select Box offers F1 (Select Column Type). If function key F1 is pressed, then the Select Box lists six possible functions that could occupy that column. When the required function is chosen, function key F2 (Enter Column Heading) may be selected if the text making up the column heading requires alteration.

In this way the system allows the user to choose which (if any) functions are to be shown in the last three columns of the results page, and relabel them if necessary.

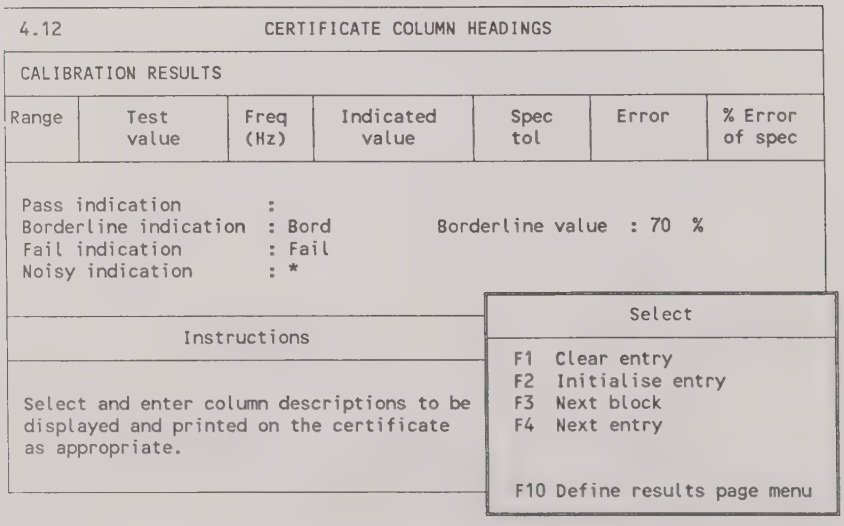


Fig 10.13 Certificate Collumn Headings Menu

The selectable columns are defined as follows:

F1 Absolute Specification:
This selection will cause two collumns of specifications (higher and lower absolute tolerances) to be printed or displayed under on collumn heading.

F2 %/ppm/d Specification:
This selection will display the specification for a reading to be displayed in %, ppm or digits, and will cause the collumn header to be displayed as Spec(ification) Tol(erance). The choice of % / ppm / digits is made in the procedure generator (refer to section 9, paragraph 9.10.19).

F3 Error:
This selection will display the error in the reading taken from the instrument under test, displayed in % / ppm / digits, as defined in the procedure generator (refer to section 9, paragraph 9.10.19.

F4 % Error of Spec:
This selection will display the ratio of Error to Specification, expressed as a percentage. Less than 1% means the instrument agrees exactly with the calibrator's output while 100% or greater represents a failure. This percentage term is a useful indicator of how far in or out of specification a particular reading is. Note that if the % Error of Spec is calculated as 1000% or greater, then the entry in this collumn will be displayed as ***%

F5 % Margin of Spec:
This selection causes the entry in this collumn to be expressed as 100 - % Error of Spec. When in perfect calibration (the unit under test and the calibrator agree), the % Margin of Spec is 100%

F6 Pass/Fail:
This selection provides an indication of whether the result lies within specification (a Pass or a Borderline) or outside of specification (a Fail).

10.5.3.2 Result Indicators

When a result is taken using the Calibrate program, it can either pass against specification, fail against specification, be registered as noisy, or be classed as borderline.

Using this section of the menu, the user may define symbols or words which are then used to indicate on the calibration certificate that certain results have passed, failed or were noisy.

A borderline result is one which passes against specification but which exceeds a certain percentage of that specification. The borderline percentage of specification can be defined by the user. For example, it may be felt that if certain readings exceed 75% of the instrument's specification, then that instrument is in need of adjustment. The default value for borderline is set at 70%.

The Borderline Value is set as a percentage in the Certificate Column Headings Menu, along with an indicator of a borderline pass, which will normally be printed on the calibration certificate against the relevant results.

10.5.4 System Uncertainty

10.5.4.1 Introduction

When a full calibration certificate is printed, the results for each separate function are printed on different pages. At the foot of each page is a space reserved for the printout of the Portocal system specification for that function. These specifications are allocated to a particular function in the Procedure Generator - Function Entry Menu (refer to section 9, paragraph 9.9.10.2). The standard certificate specifications are the 90 day specifications of the Portocal system, using Datron's own calibration uncertainties with additional uncertainties added (especially at high frequency ACV) due to the nature of the general purpose lead kit provided. Should the user recalibrate the calibrators of the Portocal system, or use a special-purpose lead setup, it may be necessary to alter these specification numbers, to reflect the modified traceability.

10.5.4.2 Operation

The various texts associated with system uncertainty for DC volts, AC volts, resistance, DC current and AC current, may be altered through selection of function keys F2 to F6 on the Define/Edit Results Page Menu (Fig 10.12). Each function key will display a separate menu where these numbers may be edited or changed. Full text editing facilities as described in section 5, paragraph 5.2 are available.

Function key F7 (Special) will display a page with a blank text field which may be used to enter uncertainty details if Special Function has been selected in the Procedure Generator.

(Note: If no printout of specifications on the certificate is required, a certificate may be created where the relevant parts of text are deleted.)

10.5.5 Operator Comments

Selecting function key F8 (Operator Comments) on the Define/Edit Results Page Menu (Fig 10.12) will display the Certificate Results Page Operator Comments Menu.(Fig 10.14) These comments appear at the foot of each results page and may be edited accordingly.

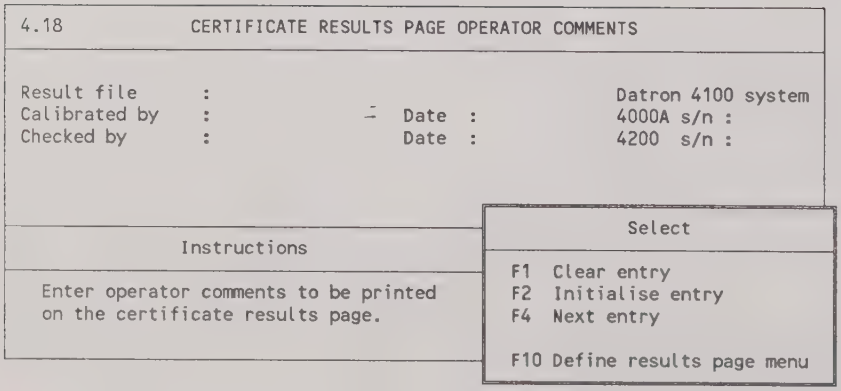


Fig 10.14 Certificate Operator Comments Menu

10.6 Save Certificate

10.6.1 Introduction

When a new certificate format has been designed and is residing in the temporary file, the Save Certificate function must be performed to save the contents of the temporary file into the certificate library before that certificate may be used by any of the other programs.

10.6.2 Operation

Selecting function key F4 (Save Certificate) on the Certificate Generator Menu (fig 10.2) will cause a cursor to flash in the Password Box. Correct entry of the Procedure / Certificate generator password will display the Save Certificate Menu.(fig 10.15) This will list up to 20 different types of certificate stored on disk and allows the user to allocate a certificate number and append an alphanumeric comment to the certificate, for identification purposes.

Enter the required certificate number and press the ↵ key. A suitable comment can then be typed in followed by the ↵ key.

Selecting function key F1 (Save certificate) will then save that particular certificate under the required number. A warning will be given if the certificate number has already been allocated to another certificate, and in such cases, selecting function key F1 will overwrite the old certificate with the version held in the temporary file.

Selection of F10 (Certificate Generator Menu) will return the Certificate Generator Menu (Fig 10.2) to the screen.

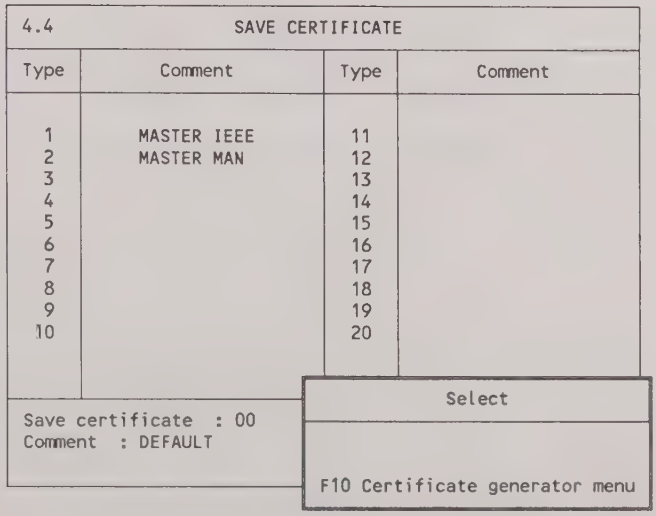


Fig 10.15 Save Certificate Menu

10.7 Delete Certificate.

10.7.1 Introduction

Delete certificate allows an operator to erase an obsolete certificate design from the disk, thereby creating space for a new certificate.

10.7.2 Operation

Selecting function key F5 (Delete Certificate) on the Certificate Generator Menu (Fig 10.2) will cause a cursor to flash in the Password Box. Correct entry of the Procedure / Certificate generator password will display the Delete Certificate Menu (Fig 10.16). This displays the library of all 20 certificates that are currently stored on disk.

Entering the number of the certificate to be deleted followed by the ↵ key, and selecting function key F1 (Delete Certificate) will cause that certificate to be deleted from the library.

Selection of function key F10 (Certificate Generator Menu) will return the Certificate Generator Menu (Fig 10.2) to the screen.

10.8 Print Certificate

10.8.1 Introduction

Print Certificate provides a printout of the certificate design held in the temporary file which may be used to check for corrections of content and layout.

10.8.2 Operation

Selection of function key F6 (Print Certificate) on the Certificate Generator Menu, will cause a representation of the title page and results page of the certificate currently held in the temporary file, to be printed out. This is an invaluable aid for checking any certificate design.

The format of the printout comprises of a complete title page and results page, with all the system uncertainties appended to the end of the results page.

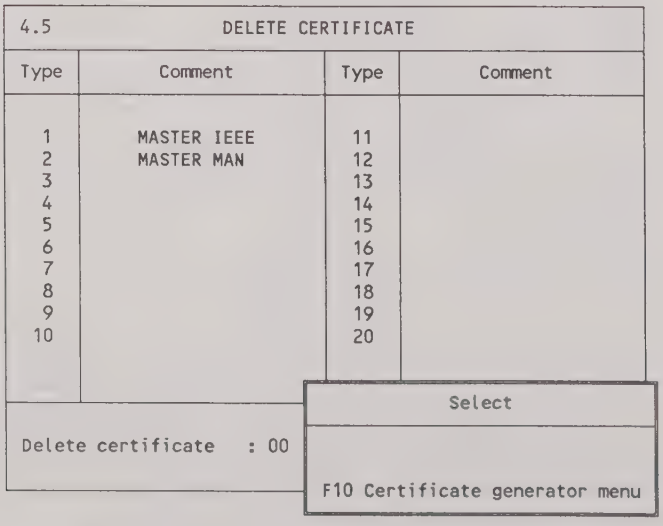


Fig 10.16 Delete Certificate Menu

10.9 Send Certificate

10.9.1 Introduction

The Send Certificate Menu allows the user to select a certificate from the certificate library and transfer it either to the hard disk or to a floppy disk (possibly to take it to another Portocal system), or send it via an RS-232C data communications link to another Portocal system. Selection of function key F8 (Send Certificate) from the Certificate Generator Menu (Fig 10.2) will display the Send Certificate Menu (Fig 10.17).

10.9.2 Send Certificate Number

Enter the number of the certificate required for transfer and select the ↵ key.

10.9.3 Transfer Medium

The select box offers the choice of transferring the procedure to hard or floppy disk (F1), or to the RS-232C communications port (F2).

10.9.3.1 Transfer to Disk

If transfer to disk was selected, then an additional prompt is provided:

Drive: \ Path \ Filename

This allows the user to specify which drive and under what directory and file name labels the data is sent to.
An understanding of DOS would help the user to make use of this facility.

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the certificate to the C drive (the hard disk) into a file called ABC.1, held in a sub-directory called XYZ. Note that the file extensions is fixed and may not be changed.

C:\ABC will transfer the certificate to the C drive into a file called ABC.1, under the main (root) directory.

A:\ABC will transfer the certificate to the root directory of the floppy disk (drive A) into a file called ABC.1.

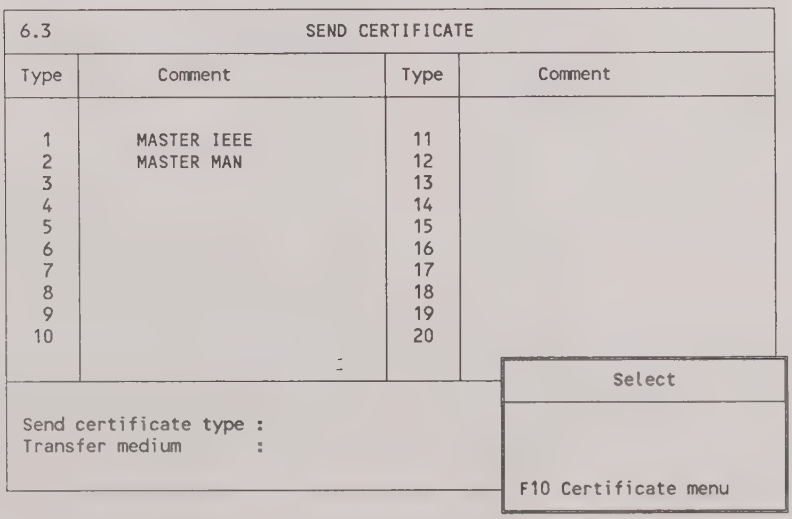


Fig 10.17 Send Certificate Menu

ABC will copy the certificate to the default drive (drive C - hard disk), under the existing directory (PORTOCAL), with a file names of ABC.1.

XYZ\ABC will copy the certificate to the default drive (drive C - hard disk), under a sub-directory XYZ beneath the PORTOCAL directory, in a file named ABC.1.

When the Drive: \ Path \ Filename parameter has been entered, select F3 for Send Certificate and the transfer process will begin.

The Portocal software does not check for the validity of the entered Drive: \ Path \ Filename parameter. If, however, an error is detected by DOS, the software will detect this condition, display a suitable error message (typically "Path/File Access Error"), abort the requested transfer and force the Certificate Generator menu (Fig 10.2).

10.9.3.2 Send to RS-232

If, at the Transfer Medium prompt, the F2 for RS-232C is selected, then the system prepares to send the certificate to another Portocal system via the RS-232C communications port. No other parameters are required, and the selection of F3 (Send Certificate) will initiate the transfer.

(It does not matter when sending certificates via the RS-232C interface whether the receiver is activated before the sender or vice versa. Both will wait until they are both ready before transmission occurs.)

10.10 Receive Certificate

10.10.1 Introduction

The Receive Certificate function allows the user to receive a certificate format from a) files placed on a floppy disk or hard disk by the Send Certificate function or b) another Portocal system via the RS-232C interface and store it anywhere within the certificate library. Selection of function key F7 (Receive Certificate) from the Certificate Generator menu (Fig 10.2) will cause a cursor to flash against the password prompt. Correct entry of the Procedure/Certificate password followed by the ↵ key will display the Receive Certificate Menu, Fig 10.18

10.10.2 Receive Certificate Number

Enter the Certificate number where the transferred certificate is to be stored followed by the ↵ key.

10.10.3 Transfer Medium

The select box offers the choice of transferring the certificate from hard or floppy disk, (F1) or from the RS-232C communciations port (F2).

10.10.3.1 Transfer from Disk

If transfer from disk was selected, then an addiional prompt is provided:

Drive: \ Path \ Filename

This allows the user to specify which drive and under what directory and file name labels the certificate is stored in.
An understanding of DOS would help the user to make use of this facility.

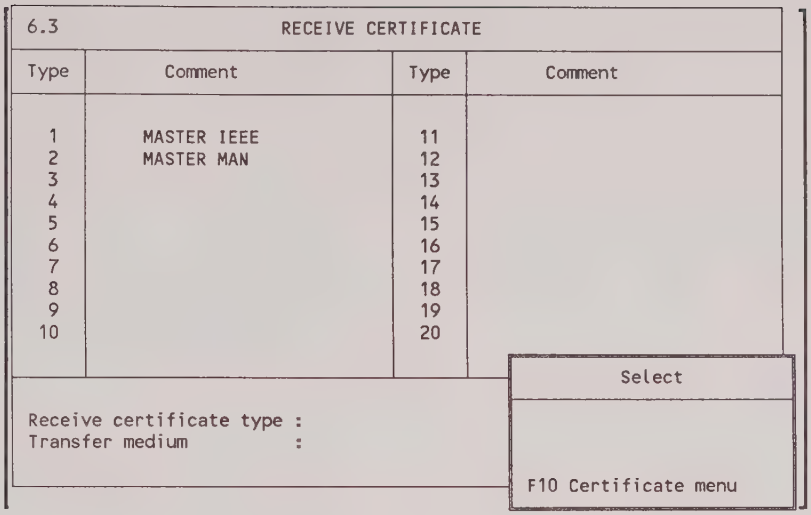


Fig 10.18 Receive Certificate Menu

Path and file name can be entered in a variety of ways, and some examples will help.

C:\XYZ\ABC will transfer the certificate from the C drive (the hard disk), from a file called ABC.1, held in a sub-directory called XYZ. Note that the file extension is fixed and may not be changed.

C:\ABC will transfer the certificate from the C drive, from a file called ABC.1, held in the main (root) directory.

A:\ABC will transfer the certificate from the root directory of the floppy disk (drive A), from a file called ABC.1.

ABC will copy the certificate from the default drive (drive C - hard disk), under the existing directory (PORTOCAL), from file named ABC.1.

XYZ\ABC will copy the certificate from the default drive (drive C - hard disk), under a sub-directory XYZ beneath the PORTOCAL directory, from a file named ABC.1.

When the Drive: \ Path \ Filename parameter has been entered, select F3 for Receive Certificate and the transfer process will begin.
The Portocal software does not check for the validity of the entered Drive: \ Path \ Filename parameter. If, however, an error is detected by DOS, the software will detect this condition, display a suitable error message (typically "Path / File Access Error" or "File Not Found"), abort the requested transfer and force the Certificate Generator menu (Fig 10.2).

10.10.3.2 RS-232 port

If function key F2 is selected, then the system prepares to receive the certificate via the RS-232C communications port from another Portocal system. No other parameters are necessary, and selection of F3 (Receive Procedure) will initiate the requested transfer

(It does not matter when sending procedures via the RS-232C interface whether the receiver is activated before the sender or vice versa. Both will wait until they are both ready before transmission occurs.)

SECTION 11: THE SYSTEM MANAGER

11.1 Introduction

The System Manager program provides access to various tools and information required for the smooth administration of the system and includes the following facilities.

i) System Utilities: Provides an easy - to - use interface between the Portocal operating environment and various DOS utilities, such as floppy disk and magnetic tape formatting, backup to floppy disk and magnetic tape and directory listings.

ii) Archive Results: Provides a means of transferring results from hard disk to floppy disk for long term storage.

iii) Delete Results: Allows deletion of obselete results from the results database.

iv) Inventory Search: Allows searching through the instrument database in order to extract information on future workloads, instrument locations and so on.

v) Instrument Entry: Allows entry of instrument details onto the system prior to any calibration, and modification of any instrument details already stored in the instrument database.

vi) System Configuration / History: Allows the System Manager to configure the system, install calibrator(s) and modify the System History file.

vi) Universal Titles: Allows editing and altering the titles and headings used throughout the screen displays and calibration certificates in order to reflect the user's normal terminology, and defining the system passwords.

11.2 Operation.

From the Portocal System Menu (Fig 11.1), select function key F3 (System Manager Menu) to display the Manager Menu (Fig 11.2), from where the various manager facilities can be obtained through function key selection.

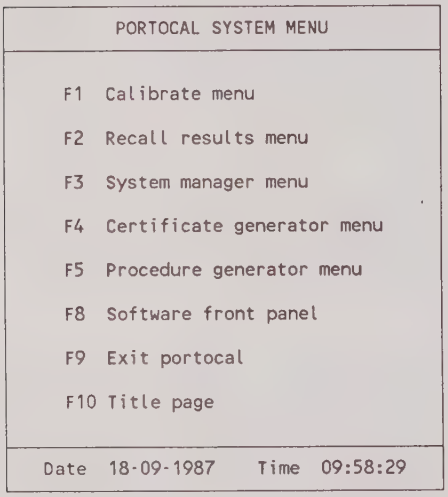


Fig 11.1 Portocal System Menu

11.3 Disk Utilities

11.3.1 Introduction

It is a good practice to make copies of all the programs and files held on the hard disk and store them on floppy disk. If this is done regularly, so that new procedures and certificate designs are also copied, then, in the unlikely event of a hard disk failure or database corruption, all of the programs and files may be restored to the hard disk and the risk of losing any data is minimized.
The Procedure and Certificate Generators provide the ability to make individual Procedure and Certificate backups, by using the Send Procedure and Send Certificate facilities (refer to section 9, paragraph 9.16 and section 10, paragraph 10.9 respectively). This is, however, not a substitute for performing regular backups of the entire Portocal database.

Disk Utilities provides a means to access the DOS Backup, Format, and Directory utilities without the need to leave Portocal first. The user is able to backup the programs and files held on the hard disk as well as format blank floppy disks so that they can be used for backup or archiving. Additionally, a printout of the directory listing all programs and files on the hard disk or a floppy disk may be obtained.

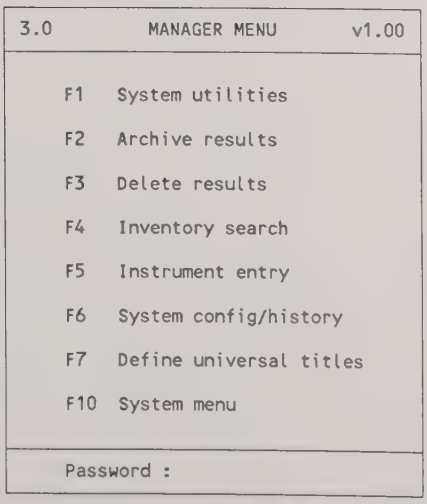


Fig 11.2 System Manager Menu

11.3.2 Operation

Selecting function key F1 (Disk Utilities) on the Manager Menu (Fig 11.2) will cause a flashing cursor to appear in the Password box. Enter the correct Manager password, followed by the ↵ key to display the Manager - Disk Utilities Menu (Fig 11.3)

This menu offers up to six utilities, with the presence or not of the F5 and F6 choices depending on whether or not the tape backup oprtion is enabled (refer to paragraph 11.8.4.16).

F1 Backup to disk: offers the opportunity to backup the entire database, backup the procedure library, backup the certificate library or perform an incremental backup (since last).

F2 Format disk: offers the opportunity to format a floppy disk in preparation for a backup operation, for example.

F3 Print directory: produces a hard copy directory listing of all the files resident on a floppy disk, or in the Portocal database.

F4 File Maintenance: performs automatic redundant space ressurection of the Procedure and Instrument databases.

F5 Backup to Tape: offers the opportunity to backup the entire disk or the Portocal directory to the magnetic tape backup unit (only if enabled).

F6 Format Tape: offers the opportunity to format a magnetic tape in preparation for a backup operation (only if enabled).

Function key F10 (Manager Menu) will return the Manager Menu (Fig 11.2) to the monitor screen.

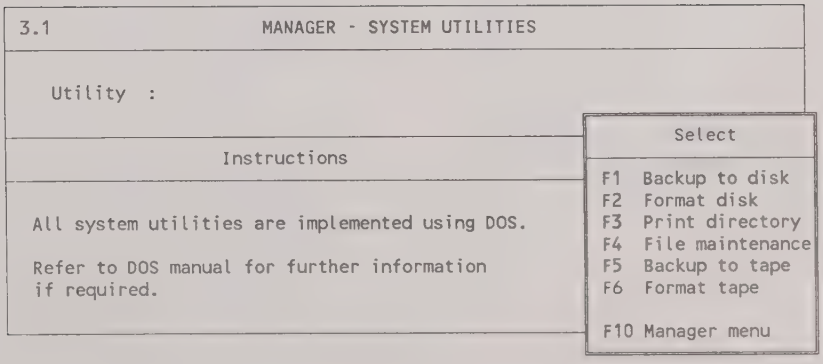


Fig 11.3 Manager - System Utilities Menu

11.3.2.1 Backup to disk

Selecting function key F1 (Backup to Disk) will cause a further set of choices to appear in the Select Box, as in Manager - Backup Utility Menu (Fig 11.4).

F1 Portocal. This function key will prepare the system to copy every program and file resident in the Portocal sub-directory on the hard disk onto a number of floppy disks. It should be noted that the disks used to hold the backup should be already formatted, and that any information contained in the root directory of the floppy disk will be deleted.

The number of disks required by this backup process will depend on the number of procedures, certificate formats, instruments and calibration results resident, as well as the space available on each blank disk.
As a general rule, on an IBM-XT with 360kbyte floppy disk drives, an unmodified Portocal database (as stored on the set of six master disks originally supplied) will require 6 disks, each set of 100 calibration results will require an additional disk, and each set of 10 procedures will require an additional disk.

This utility is performed by the DOS command file BACKUP, which will provide all of the necessary prompts, and return the Manager - Disk Utilities menu (Fig 11.4) to the screen on completion.
If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility Backup. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.8)

F2 Procedures. This function key will prepare the system to copy all the procedure files from the hard disk onto a number of floppy disks. Again, the disks should be already formatted, and any information contained in the root directory of any of these floppy disks will be deleted.

The number of disks required will typically be one disk per 10 procedures resident in the Procedure Library.

Special note for HP-Vectra users: the MS-DOS backup command used to perform the procedure backup produces two prompts that are passed directly from DOS to the user:

a) "Insert Archive Diskette 01 in Drive A:
WARNING ! All Files in the \ root directory Will Be Deleted !
Press Any Key to Continue, Control-C to Abort"

This indicates that a blank disk should be placed in the floppy disk drive, onto which the backup process may copy the relevant files.

b) "Insert Diskette to Append to in Drive A:
Press Any Key to Continue, Control-C to Abort"

This indicates that the user should leave the present floppy disk in the disk drive, as some additional files are to be appended to the information already stored on the disk.
This utility is performed by the DOS command file BACKUP, which will provide all of the necessary prompts, and return the Manager - Backup Utility menu (Fig 11.4) to the screen on completion.

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility Backup. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.8)

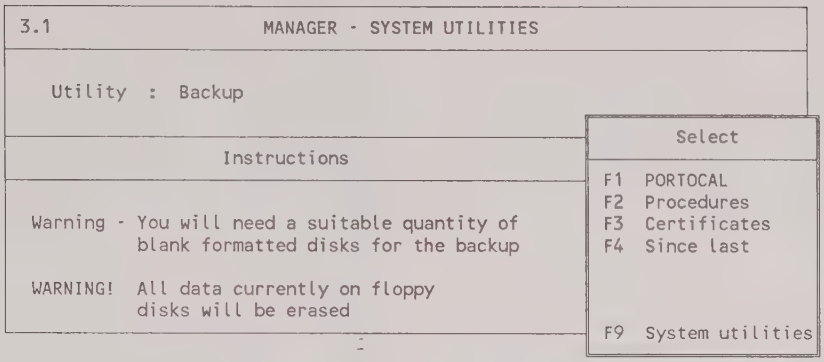


Fig 11.4 Manager - Backup Utility Menu

F3 Certificates: This function key will prepare the system to copy all the certificate files from the hard disk onto a blank formatted disk. This operation will only require one blank, formatted 360kbyte or 1.2Mbyte disk. This utility is performed by the DOS command file BACKUP, which will provide all of the necessary prompts, and return the Manager - Backup Utility menu (Fig 11.4) to the screen on completion.

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility Backup. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.8)

F4 Since Last: This function key will prepare the system to copy all programs and files associated with Portocal that have been modified since the previous occasion when the Backup Portocal facility was used. Again, a suitable number of blank formatted disks will be required, the number depending on the time interval and level of usage of the system. Note that the Backup Since Last utility will over-write any information that is already on the floppy disk. Thus a blank floppy disk is required as the target for each Backup Since Last performed.

This utility should only be used to provide a temporary bridge between the last full system backup and the system's current state. This is not a substitute for performing regular full system backups.
This utility is performed by the DOS command file BACKUP, which will provide all of the necessary prompts, and return the Manager - Backup Utility menu (Fig 11.4) to the screen on completion.

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility Backup. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.8)

F9 System Utilities will redisplay the Manager - System Utilities menu (Fig 11.3).

11.3.2.2 Format disk

Function key F2 (Format disk) from the Manager - System Utilities menu (Fig 11.3) displays the Manager - Format Utility menu (Fig 11.5), and prepares the system to format floppy disks so that they may be used for backup of programs and files, or for archiving of results.

Selection of function key F1 (Continue) will cause the program to transfer control to DOS, and the screen display will give instructions on what has to be done in order to proceed.

This utility is performed by the DOS command file FORMAT, which will provide all of the necessary prompts, and return the Manager - System Utilities menu (Fig 11.3) to the screen on completion.

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility Backup. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.7)

11.3.2.3 Print Directory

Selection of function key F3 (Print directory) from the Manager - System Utilities menu (Fig 11.3) will display the Manager - Directory Utility menu (Fig 11.6) and will prepare the system to printout a complete directory of all programs and files held on the hard disk under the Portocal directory or on any floppy disk currently in the floppy disk drive. The Select Box offers F1 (Portocal) and F2 (Floppy disk) so that the choice can be made. There will be a short pause after selection of the required function key before the printout begins, as the program copies the directory into a file and sorts the file into alphabetical order. The Manager - System Utilities menu (Fig 11.3) will return on completion.

If the message "53 / 60000 File not found" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the DOS utility SORT. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraphs 11.8.4.5 and 11.8.4.10)

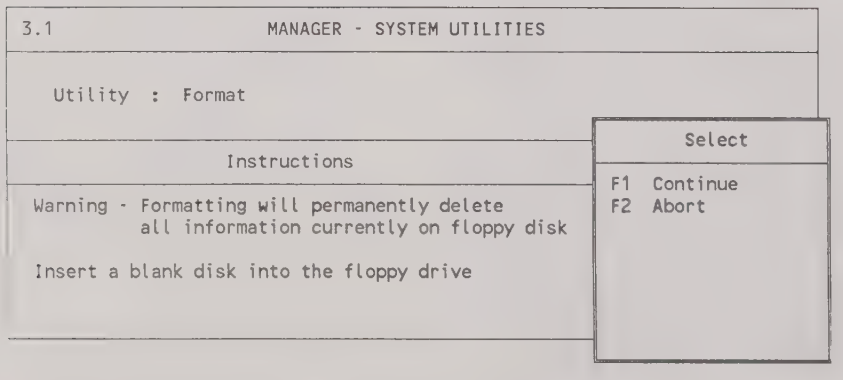

3.1 MANAGER - SYSTEM UTILITIES
Utility : Format
Instructions
Warning - Formatting will permanently delete all information currently on floppy disk
Insert a blank disk into the floppy drive
Select
F1 Continue
F2 Abort

Fig 11.5 Manager - Format Utility Menu

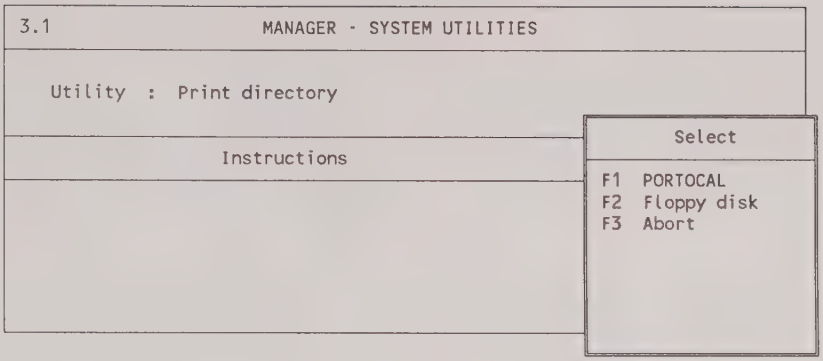


Fig 11.6 Manager - Directory Utility Menu

11.3.2.4 File Maintenance

Regular use of the Procedure Generator, Instrument Entry and Calibration programs will result in redundant space collecting in the procedure and instrument databases. Over a period of time, this redundant space will cause database accesses to become inefficient. Selection of function key F4 (File Maintenance) will cause the system to perform automatic redundant space resurrection, and so keep the databases performing at maximum efficiency. This utility is performed by a Datron-supplied program, requiring no interaction from the user, and any error messages displayed should be reported to the factory or your local representative. It is recommended that file maintenance be performed on a regular basis, typically once per week if the system is being fully utilized.

11.3.2.5 Backup to Tape

From the Manager - Disk Utilities menu (Fig 11.3), selection of F5 (Backup to Tape) will display the Manager - Tape Backup Utility menu (Fig 11.7). Three function key selections are available at this point:

F1 Portocal. This function key will prepare the system to copy every program and file resident in the Portocal sub-directory on the hard disk onto a tape cartridge installed in the Tape Backup Unit. It should be noted that the tape should be already formatted (refer to paragraph 11.3.2.6), and that the Tape Backup unit driver software will provide all the necessary prompts and finally return control to the Manager - System Utilities menu (Fig 11.3)

F2 Entire System. This function key prepares the system to backup the entire contents of the C: drive to a magnetic tape, which must be already formatted (refer to paragraph 11.3.2.6)

F9 System Utilities. This function key will return the system to the Manager - Disk Utilities menu (Fig 11.3)

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the tape backup unit driver software. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraph 11.8.4.5 and section 3, paragraphs 3.2.1.7, 3.2.1.8).

11.3.2.6 Format Tape

From the Manager - Disk Utilities menu (Fig 11.3), selection of F6 (Format Tape) will display the Manager - Format Tape Utility menu (Fig 11.8). Two function key selections are available at this point:

F1 Continue. This function key will prepare the system to format a magnetic tape casset installed in the Tape Backup Unit. The Tape Backup Unit driver software will provide all of the necessary prompts to proceed with the operation, and on completion, control will return to the Manager - System Utilities Menu (Fig 11.3)
It should be noted that the Tape Backup unit driver software will provide all the necessary prompts and finally return control to the Manager - System Utilities menu (Fig 11.3)

F2 Abort will terminate the Tape Format utility and return control to the Manager - System Utilities menu (Fig 11.3)

If the message "Bad Command or File Name" is echoed to the screen, this indicates that Portocal was not correctly informed of the location of the tape backup unit driver software. To rectify this situation, it will be necessary to modify the contents of the System Manager - System Configuration menu (refer to paragraph 11.8.4.5 and sectiopn 3, paragraphs 3.2.1.7, 3.2.1.8)

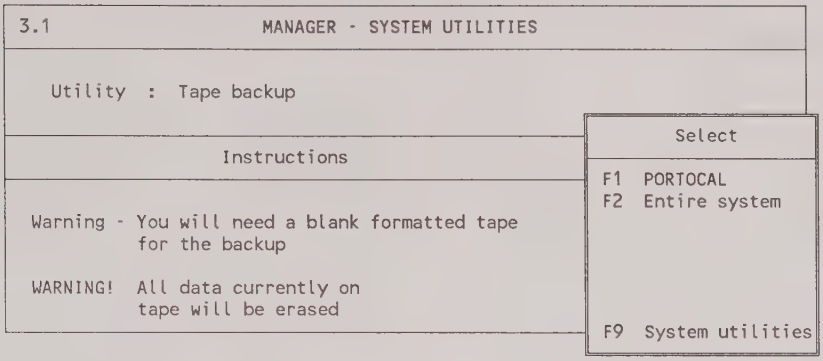


Fig 11.7 Manager - Tape Backup Utility Menu

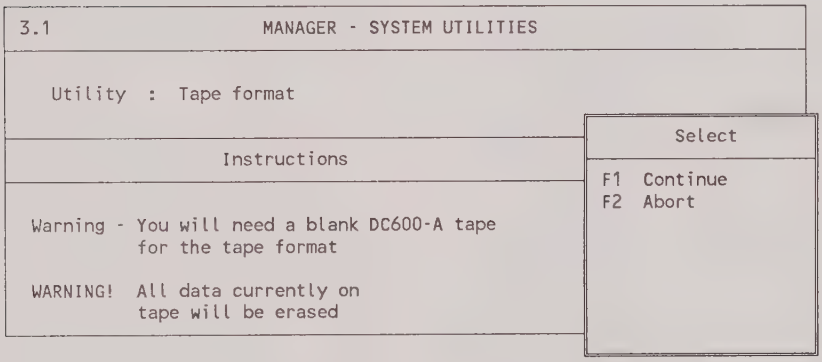


Fig 11.8 Manager - Format Tape Utility Menu

11.3.3 Recovering the System

IN THE EVENT OF A SYSTEM HARD DISK FAILURE OR CRASH IT IS HIGHLY RECOMMENDED THAT YOU CONTACT EITHER THE FACTORY OR YOUR LOCAL REPRESENTATIVE TO DETERMINE THE OPTIMUM WAY OF RESTORING THE SYSTEM.

Alternatively, assemble the most recent full system backup performed, and any disks that contain incremental backups (backup since last, backup of procedures and backup of certificates) since that date.

Then, refer to the DOS manual supplied with your system for information on the RESTORE command, noting that the backups must be restored in the order in which they were created.

If, however, prior backups have been made to a Tape Backup unit, it will be necessary to refer to the documentation supplied with your tape backup unit for the process to restore the system. Again, contact the factory or your local representative for further information and assistance.

11.4 Archive Results.

11.4.1 Introduction

All of the results taken by the system are stored on the hard disk, and a new file is created for each new set of calibration results taken. Over a period of time, the number of files, and the disk space occupied by those files will increase. This will result in the slowing down of the system and an increase the amount of time (and the number of disks) required for a backup

To keep track of all past results, even when they have been archived onto floppy disk, the system has a master index of results, which is kept in one file on the instrument database. This contains information on where all the results ever taken by the system are stored - either on the hard disk or on a certain floppy disk volume. When the Recall Results facility (refer to section 8, paragraph 8.2) is used, the system immediately knows where to find the requested results, prompts the operator to insert the relevant archive volume (or disk), and reads the required information. As the required disk number is stored on the instrument database, and each disk contains a unique identifier, the Recall program is able to detect if the wrong archive volume is presented to the system and provide the necessary messages and prompts to the operator.

11.4.2 Operation

Selecting function key F2 (Archive Results) from the Manager menu will cause a flashing cursor to appear in the Password Box. Correct entry of the Manager password will display the Archive Results Library menu (Fig 11.9). This menu allows the user to search through the Results database and select results for archiving, either singly, or by a two-field search similar to that available in the Recall Results program (refer to section 8, paragraph 8.2)

The bottom left hand section of the menu is where the user makes a selection on how to archive.

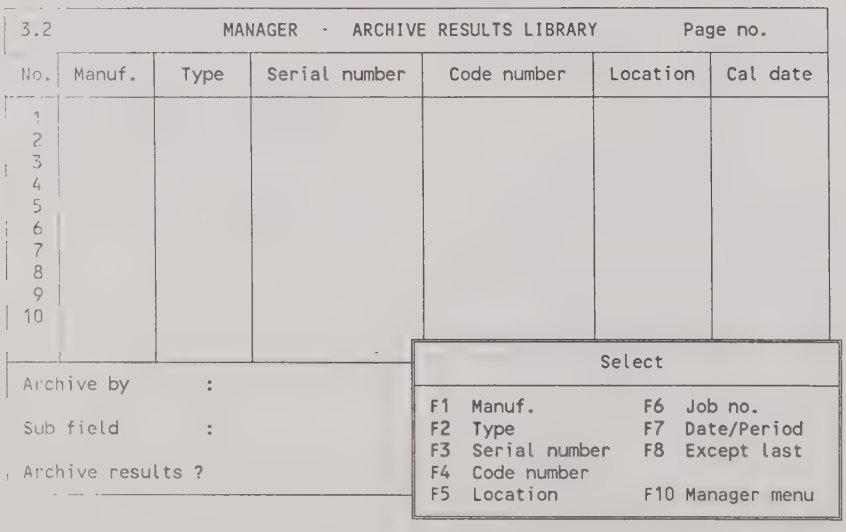


Fig 11.9 Manager - Archive Results Library Menu

11.4.2.1 Search Facilities.

These search facilities allow a set of calibration results to be selected by up to two of the following parameters:

F1 Manufacturer
F2 Instrument Type
F3 Instrument Serial Number
F4 Instrument Code Number
F5 Location
F6 Job Number
F7 The Date and Period during which the calibration was performed.
F8 Except Last.

11.4.2.2 Define Search Parameters.

With the highlighted cursor over the Archive By field, select the required primary search parameter from the available selections shown in the select window. When the parameter is entered correctly, press the ↵ key to enter that parameter.
The highlighted cursor will now step to the next field, the contents of which will be determined by the parameter selected. Enter the primary search parameter required, followed by the ↵ key. The highlighted cursor will move to the next field, called Sub Field.
Select the secondary search parameter from the available selections shown in the select window, and press the ↵ key when correct. The highlighted cursor will move to the next field, the contents of which will be determined by the parameter selected.

Some examples of the parameters available and the subsequent search performed by the system are shown below.

Primary Field: Manufacturer
DATRON
Secondary Field: Type Number
1061A
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to Datron 1061As

Primary Field: Serial Number
10904
Secondary Field: Date / Period
01-01-86 For 365 Days.
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to the instrument with serial number 10904 that were taken during 1986.

Primary Field: Serial Number
10904
Secondary Field: Except Last
The search will result in a line of information being displayed on the system monitor for all of the calibration results stored on the hard disk belonging to the instrument with the serial number 10904, except for the latest set of results taken.

There are two points worth noting:
i) The search routines differentiate between upper and lower case characters. For instance, searches by DATRON, Datron and datron are different.
ii) A wild card character, * is available. for example:

Primary Field: Customer
TEST*
(No secondary field specified)
The search will result in a line of information being displayed on the system monitor for all of the calibration results taken on instruments belonging all customers beginning with TEST, for example TEST ENGINEERING, TEST BAY, TEST SYSTEM 1 etc.

11.4.2.3 Notes on "Universal Titles"

The titles of all of the available search parameters, with the exception of Date/Period, may be edited using the System Manager - Universal Titles facility (refer to paragraph 11.9).

11.4.2.4 Perform Search.

When the search field or fields are correctly entered, select the F9 key to initiate the search. The system will locate those results stored on the hard disk that match the search criteria entered, and display one line of information on the screen for each of the results found. If there are more than ten sets of results found that match the search criteria, then the select window will display a choice of "Page Library". Selection of the F9 key will update the display with the next ten sets of results, and the page number displayed in the top right hand corner of the screen will be incremented. If there are more results fitting the selection criteria, the selection of the F9 key will page the library further, until all of the results have been presented. The function of the F9 key will then revert to 'Perform Search'.

11.4.2.5 Archive Results?

When the cursor is located at the Archive Results line selection of function key F1 (Yes) will cause the system to start the archiving process.
The sequence followed by the system will then depend on a number of variables:

i) If no results have been previously archived, the system will prompt the operator to insert a new, formatted floppy disk and offer the choice of F1 (Continue) and F10 (Abort). Selection of F1 will cause the system to display "Creating Archive Vol. 1" and mark the disk with a file containing this information. When the archive volume has been created, the operator will be prompted to insert archive volume number 1 and will be offered the choice of F1 (Continue) and F2 (Abort). As this disk is already in the floppy disk drive, selection of F1 will initiate the archiving of the selected results and the system will display the message "Archiving in Progress". As each set of results is archived, the details of that set of results is echoed to the screen. When the archive process has finished, the Archive Results Library menu (Fig 11.9) will return to the screen.

ii) If some results have been previously archived, the system will display the message "Insert Archive Volume XX" (where XX represents the latest archive disk created), and offer the choice of F1 (Continue) or F2 (Abort). On selection of F1, the responses generated by the system depend on a number of variables:

a) If the correct achive volume is inserted, and F1 to commence archiving is selected, then the system displays the message "Archiving in progress" and attempts to transfer the selected results to the archive disk. As each set of results is transferred, the details of that particular set of results is displayed on the screen. When the archive process has finished, the Archive Results Library menu (Fig 11.9) will return to the screen.

b) If the correct archive volume is inserted, and F1 to commence archiving is selected, then the system displays the message "Archiving in progres" and attempts to transfer the selected results to the achive disk.
However, if the disk then becomes full, the archive process is interrupted while the system prompts the operator to insert a new, formatted disk (which will become the next archive volume in the sequence) and offers the choices of F1 (Continue) and F10 (Abort).
When the new disk has been inserted and F1 (Continue) selected, the message "Creating Archive Volume XX" (where XX represents the next disk in the sequence) will be displayed. Once the new archive disk has been created, the archiving process will continue and the message "Archiving in progress" will be displayed. When the selected results have all been archived, the Archive Results Library menu (Fig 11.9) will return to the screen.

c) If a new, blank, formatted disk is inserted, the message "Incorrect Disk ! Found Archive Volume 0" will be displayed and the operator will be offered the choices F1 (Re-try) and F2 (Start new disk).
If it is required, locate the correct archive volume, insert in the floppy disk drive and select F1 to re-try.
If, however, it is wished to start a new archive disk, leave the floppy disk in the drive and select F2. The message "Creating Archive Volume XX" (where XX represents the next disk in the sequence) will be displayed while the system marks the disk as being Archive Volume XX. The system will then display the message "Archiving in progress" and echo the details of each set of results to the screen as they are transferred to the floppy disk. When the process has finished, the Archive Results Library menu (Fig 11.9) will be displayed.

d) If a disk is inserted that is already an archive volume (if it has previously been marked by the archive program as an archive volume), but the volume number is out of sequence, then the message "Incorrect Disk ! Found Archive Volume N" will be displayed and the operator will be offered the choices of F1 (Re-try) and F2 (Start new disk).
If it is required, locate the correct archive volume, insert in the floppy disk drive and select F1 to re-try.
If, however, it is wished to start a new archive disk, locate a new, formatted disk, insert it into the floppy disk in the drive and select F2. The message "Creating Archive Volume XX" (where XX represents the next disk in the sequence) will be displayed while the system marks the disk as being Archive Volume XX. The system will then display the message "Archiving in progress" and echo the details of each set of results to the screen as they are transferred to the floppy disk. When the process has finished, the Archive Results Library menu (Fig 11.9) will be displayed.

11.5 Delete Results

Delete results provides a facility to remove all references to unwanted results from the hard disk. This not only deletes the results files, but also removes any indication of their existence from the Master Results Index.

11.5.1 Operation

Selecting function key F7 (Delete Results) from the Manager Menu (Fig 11.2) will display the Delete Results Library menu (Fig 11.10) after correct entry of the System Manager password. The upper part of this page is an area where multiple pages, each showing up to ten sets of details, can be displayed. These details are concerned with sets of results which have been found using the search facilities shown in the lower part of the menu.

11.5.2 Delete by

These search facilities allow a set of calibration results to be selected by up to two of the following parameters:

F1 Manufacturer
F2 Instrument Type
F3 Instrument Serial Number
F4 Instrument Code Number
F5 Location
F6 Job Number
F7 The Date and Period during which the calibration was performed.

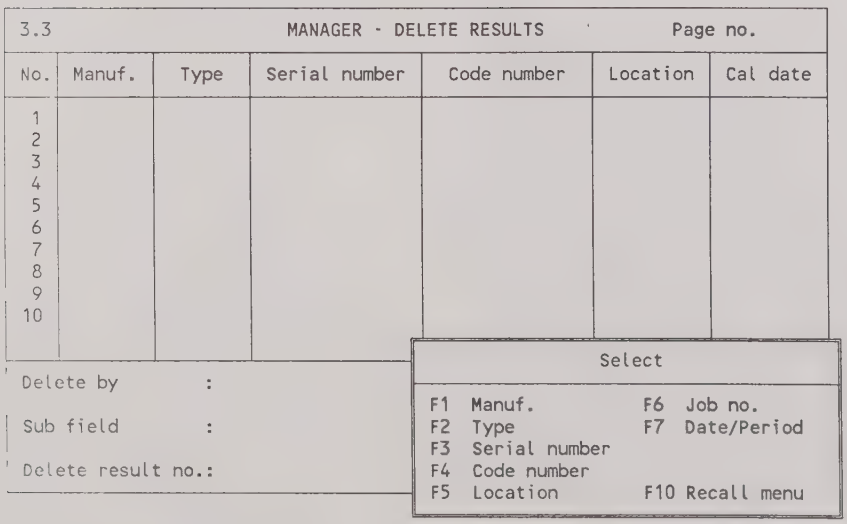


Fig 11.10 Manager - Delete Results Library Menu

11.5.2.1 Define Search Parameters.

With the highlighted cursor over the Delete By field, select the required primary search parameter from the available selections shown in the select window. When the parameter is entered correctly, press the ↵ key to enter that parameter.
The highlighted cursor will now step to the next field, the contents of which will be determined by the parameter selected. Enter the primary search parameter required, followed by the ↵ key. The highlighted cursor will move to the next field, called Sub Field.
Select the secondary search parameter from the available selections shown in the select window, and press the ↵ key when correct. The highlighted cursor will move to the next field, the contents of which will be determined by the parameter selected.

Some examples of the parameters available and the subsequent search performed by the system are shown below.

Primary Field: Manufacturer
DATRON
Secondary Field: Type Number
1061A
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to Datron 1061A's.

Primary Field: Serial Number
10904
Secondary Field: Date / Period
01-01-86 For 365 Days.
The search will result in a line of information being displayed on the system monitor for all of the calibration results belonging to the instrument with serial number 10904 that were taken during 1986.

There are two points worth noting:
i) The search routines differentiate between upper and lower case characters. For instance, searches by DATRON, Datron and datron are different.
ii) A wild card character, * is available. for example:

Primary Field: Customer
TEST*
(No secondary field specified)
The search will result in a line of information being displayed on the system monitor for all of the calibration results taken on instruments belonging all customers beginning with TEST, for example TEST ENGINEERING, TEST BAY, TEST SYSTEM 1 etc.

11.5.2.2 Notes on "Universal Titles"

The titles of all of the available search parameters, with the exception of Date/Period, may be edited using the System Manager - Universal Titles facility (refer to paragraph 11.9).

11.5.2.3 Perform Search.

When the search field or fields are correctly entered, select the F9 key to initiate the search. The system will locate those results stored on the hard disk that match the search criteria entered, and display one line of information on the screen for each of the results found. If there are more than ten sets of results found that match the search criteria, then the select window will display a choice of "Page Library". Selection of the F9 key will update the display with the next ten sets of results, and the page number displayed in the top right hand corner of the screen will be incremented. If there are more results fitting the selection criteria, the selection of the F9 key will page the library further, until all of the results have been presented. At this point, the function of the F9 key reverts to "Do search".

11.5.2.4 Previously Archived Results

Any details displayed on the screen after a search which show an asterisk (*) against the Cal date will be associated with results which have already been removed from the hard disk and archived onto a volume of floppy disk. These results cannot be deleted, and will be ignored if they are included among the results to be deleted.

11.5.2.5 Delete Result No.

This entry allows the user to select either function key F1 (All) or type in a number from 1 to 10, corresponding to an individual result as displayed on the screen. If 'All' is selected, then the system will prepare to delete a batch of all the results found on the hard disk as a result of a search by the chosen parameters.
Once this field holds valid data, (either 'All' or a number between 1 and 10), selection of function key F8 (Delete) will delete the selected result(s).

11.6 Inventory Search

11.6.1 Introduction

Every time an instrument is calibrated by the system, or every time instrument details are entered via the Manager - Instrument Entry Menu, the instrument database is modified accordingly. The Inventory Search program provides a facility for scanning through the instrument files held on the system.

11.6.2 Operation

Selecting function key F4 (Inventory Search) on the Manager menu (Fig 11.2) displays the Manager Inventory Search menu (Fig 11.11)

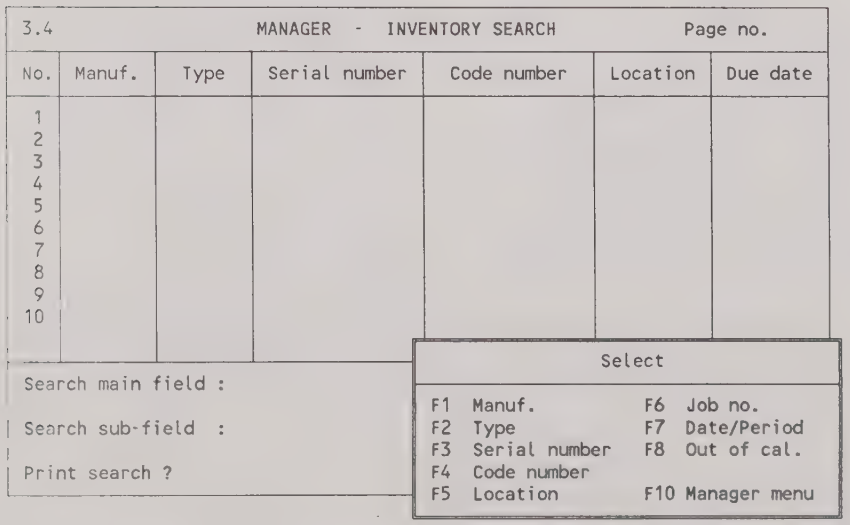


Fig 11.11 Manager - Inventory Search Menu

The upper part of this page is an area where multiple pages, each showing up to ten sets of details, can be displayed. These details are concerned with instrument or results records which have been found using the search facilities shown in the lower part of the menu.
The bottom left hand of the page provides a facility to enter up to two parameters (main field and subfield) selected from the following:

F1 Manufacturer
F2 Type
F3 Serial Number
F4 Code Number
F5 Location
F6 Job Number
F7 Date/Period
F8 Out of Cal.

11.6.2.1 Define Search Parameters.

With the highlighted cursor over the Search main field, select the required primary search parameter from the available selections shown in the select window. When the parameter is entered correctly, press the ↵ key to enter that parameter.
The highlighted cursor will now step to the next field, the contents of which will be determined by the parameter selected. Enter the primary search parameter required, followed by the ↵ key. The highlighted cursor will move to the next field, called Sub Field.
Select the secondary search parameter from the available selections shown in the select window, and press the ↵ key when correct. The highlighted cursor will move to the next field, the contents of which will be determined by the parameter selected.

Some examples of the parameters available and the subsequent search performed by the system are shown below.

Primary Field: Manufacturer
DATRON
Secondary Field: Type Number
1061A
The search will result in a line of information being displayed on the system monitor for all of the Datron 1061As held in the instrument database. The heading of the right hand collumn is "Due date", which will be the date that the last result was taken, with that instrument's calibration period added. In the case of an instrument with no results, the due date displayed will be the last calibrated date entered in the Instrument Entry menu.

Primary Field: Serial Number
10904
Secondary Field: Date / Period
01-01-86 For 365 Days.
The search will result in a line of information being displayed on the system monitor for each of the calibration results belonging to the instrument with serial number 10904 that were taken during 1986. The heading of the right hand collumn of the display is changed to "Cal Date", and the dates on which the individual calibrations were run is displayed.

Primary Field: Manufacturer
DATRON
Secondary Field: Out of Cal
The search will result in a line of information being displayed on the system monitor for all of the Datron instruments that are 'Out of Cal' on the date that the search is performed.

Primary Field: Out of Cal
Secondary Field: Date / Period
01-01-89 For 31 Days.
The search will result in a line of information being displayed on the system monitor for all of the the instruments that will require calibration during Jan 1989 (assuming that Jan 1989 is in the future.)

There are two points worth noting:
i) The search routines differentiate between upper and lower case characters. For instance, searches by DATRON, Datron and datron are different.
iii) A wild card character, * is available. for example:

Primary Field: Customer
TEST*
(No secondary field specified)
The search will result in a line of information being displayed on the system monitor for all of the calibration results taken on instruments belonging all customers beginning with TEST, for example TEST ENGINEERING, TEST BAY, TEST SYSTEM 1 etc.

11.6.2.2 Notes on "Universal Titles"

The titles of all of the available search parameters, with the exception of Date/Period, may be edited using the System Manager - Universal Titles facility (refer to paragraph 11.9).

11.6.2.3 Perform Search.

When the search field or fields are correctly entered, select the F9 key to initiate the search. The system will locate those instruments or results stored on the hard disk that match the search criteria entered, and display one line of information on the screen for each of the instruments or results found. If there are more than ten sets of instruments or results found that match the search criteria, then the select window will display a choice of "Page Library". Selection of the F9 key will update the display with the next ten sets of results, and the page number displayed in the top right hand corner of the screen will be incremented. If there are more results fitting the selection criteria, the selection of the F9 key will page the library further, until all of the results have been presented. At this point, the function of the F9 key reverts to 'Do Search'.

11.6.2.4 Print Search

Once the search field(s) have been selected and the inverse video cursor is sitting at the Print Search line, function key F1 (Yes) will result in a printout of all the details of interest. This facility does not rely on the 'Do Search' function having been carried out beforehand.

11.6.2.5 Additional Considerations

Due to the method of storing the data in the Instrument database and the results library, there is the possibility of some confusion.

When an instrument is entered into the instrument database, either by the Calibrate menu (refer to section 7, paragraph 7.1.2) or by the System Manager - Instrument Entry menu (refer to paragraph 11.7), a field "last calibrated date" is created. This field is updated on completion of a calibration procedure (ie the procedure is not aborted) and only if the "Save Results" field was specified as Yes.
However, the results library contains a "date stamp" for each calibration result taken for that individual instrument. Therefore, if a calibration run is aborted and the calibration results are saved to the results library, there is a discrepancy between the "date stamp" in the results library and the last calibrated date stored in the instrument database.
Of the Inventory search parameters available, all but Out Of Cal search through the results library and extract the "date stamp" from the individual results (if results exist for that instrument). Out Of Cal extracts the required date information from the last calibrated date field in the instrument database. Therefore, searching for the same data on the Out Of Cal parameter, followed by any of the other parameters may result in different data being presented to the user.
Therefore, it is suggested that when a procedure is aborted, the option to not save results is taken.

11.7 Instrument Entry.

11.7.1 Introduction

Instrument details are stored in the instrument database, indexed by a combination of the serial number and the code number. More than one instrument may posess the same serial number, in which case, they must be differentiated by a unique code number. Conversly, more than one instrument may posess the same code number, in which case, they must be differentiated by a unique serial number.

If the instrument has been calibrated by the system before, or if the instrument details have previously been entered using this Manager Menu - Instrument Entry facility, then the combination of serial number and code number will be recognised by the system.

If the instrument is not recognised by the system, then certain information must be entered before the page of details may be saved to the instrument database. The system requires a minimum of: either a serial number or a code number or both (the combination of which must be unique), and a last calibrated date. The other details entered in the calibration menu page are optional, and if specified, will be saved to the instrument files.

11.7.2 Operation

Select function key F5 (Instrument Entry) on the Manager menu (Fig 11.2) to display the Manager - Instrument Entry menu (Fig 11.12)

11.7.2.1 New/Already on File

The first prompt allows the user to inform the system that the instrument details being entered are for a new instrument, or for one already on file.

If function key F1 (New) is selected, the system expects that the combination of serial number and code number entered later is unique. However, if function key F2 (Already on file) is selected, the system expects that the serial number and code number combination entered later is already on file. If either of these two conditions are not met, then the operator will be informed of this fact and be given the opportunity to rectify the situation.

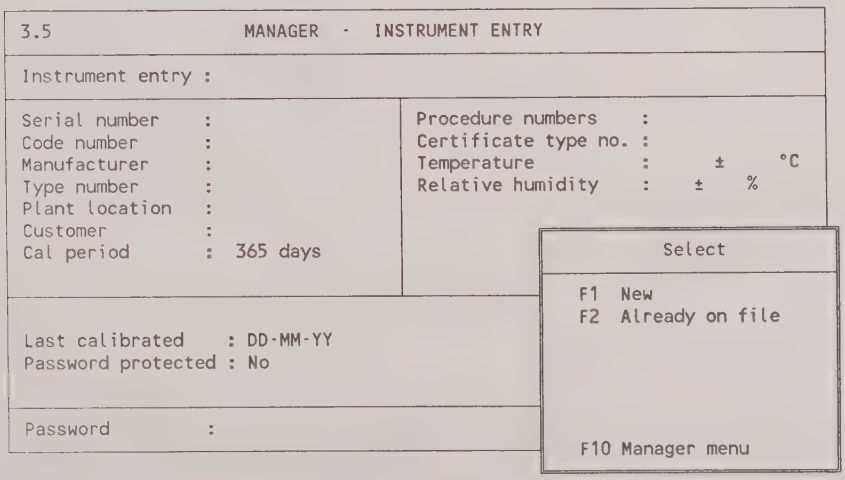


Fig 11.12 Manager - Instrument Entry Menu

11.7.2.2 Serial Number and Code Number

Enter the serial number and/or code number of the instrument to be entered or updated.

If the instrument was declared as being 'New' then the Instrument Entry program will check to ensure that an instrument with that serial number and code number combination does not already exist. If this is the case, then the rest of the instrument details may be entered. Note that the details entered into this menu will not be saved to the Instrument database until the 'Save Instrument' command is issued.
If, however, an instrument with the same serial number and code number combination is located, the message "Instrument already on file" will be displayed and the operator will be presented with the choices F1 (Continue), F2 (Change Serial Number) and F3 (Change Code Number).
Selection of F1 (Continue) will cause the cursor to move directly to the New/Existing prompt, and change the entry in that field to 'Already Exists'.
Selection of F2 (Change Serial Number) will cause the cursor to move directly to the Serial Number field, which may be changed as required.
Selection of F3 (Change Code Number) will cause the cursor to move directly to the Code Number field, which may be changed as required.

If the instrument was declared as being 'Already on File' then the Instrument Entry program will check to ensure that an instrument with the stated serial number and code number combination does already exist. If this is the case, then the details stored for that instrument will be displayed, along with a message "Warning ! Editing existing data" and the operator may modify or delete them as necessary. Note that the selected entry in the Instrument database will not be modified until the 'Save Instrument' or 'Delete Instrument' command is issued.

If, however, the stated instrument is not found, the message "Instrument not on file" will be displayed and the operator will be presented with the choices of F1 (Continue), F2 (Change Serial Number) and F3 (Change Code Number).
Selection of F1 (Continue) will cause the cursor to move directly to the New/Existing prompt, and change the entry in that field to 'New'.
Selection of F2 (Change Serial Number) will cause the cursor to move directly to the Serial Number field, which may be changed as required.
Selection of F3 (Change Code Number) will cause the cursor to move directly to the Code Number field, which may be changed as required.

11.7.2.3 "Hidden" function keys.

If the instrument was declared as being 'Already on File', and the cursor is located over the Serial Number or Code Number fields, and either a Serial Number or Code Number that the system recognises has been entered, then there are six "hidden" function keys that enable the user to step through the instrument files containing the data for each individual instrument:

i) Decrement Serial Number. The [Shift] and [F3] keys, when pressed together, will cause the information from the instrument with the previous serial number, in ASCII order, to be displayed. When the first instrument is reached, the message "This is the first serial number" will be displayed and further depression of the [Shift] and [F3] keys will not cause any further action. If an instrument with a blank serial number is currently displayed, then selection of this facility will cause the message "No Serial no. selected" to be displayed.

ii) Increment Serial Number. The [Shift] and [F4] keys, when pressed together, will cause the information from the instrument with the next serial number, in ASCII order, to be displayed. When the last instrument is reached, the message "This is the last serial number" will be displayed and the further depression of the [Shift] and [F4] keys will not cause any further action. If an instrument with a blank serial number is currently displayed, then selection of this facility will cause the message "No Serial no. selected" to be displayed.

iii) Decrement Code Number. The [Shift] and [F5] keys, when pressed together, will cause the information from the instrument with the previous code number, in ASCII order, to be displayed. When the first instrument is reached, the message "This is the first code number" will be displayed, and the further depression of the [Shift] and [F5] keys will not cause any further action. If an instrument with a blank code number is currently displayed, then selection of this facility will cause the message "No Code no. selected" to be displayed.

iv) Increment Code Number. The [Shift] and [F6] keys, when pressed together, will cause the information from the instrument with the next code number, in ASCII order, to be displayed. When the last instrument is reached, the message "This is the last code number" will be displayed, and further depression of the [Shift] and [F6] keys will not cause any further action. If an instrument with a blank code number is currently displayed, then selection of this facility will cause the message "No Code no. selected" to be displayed.

v) Display the previous instrument. The [Shift] and [F7] keys, when pressed together, will cause the information from the record in the instrument inventory immediately preceding the current instrument to be displayed. When the first instrument is reached, the message "This is the first instrument" will be displayed, and further depression of the [Shift] and [F7] keys will not cause any further action.

vi) Display the next instrument. The [Shift] and [F8] keys, when pressed together, will cause the information from the record in the instrument inventory immediately after the current instrument to be displayed. When the last instrument is reached, the meassge "This is the last instrument" will be displayed, and any further depression of the [Shift] and [F8] keys will not cause any further action.

Note that the order in which next and previous instrument functions (shift - F7 and shift-F8) are displayed is altered by the file maintenance program (refer to patagraph 11.3.2.4).

11.7.2.4 The Remaining Fields.

The remaining fields are all stored in the Instrument database when the 'Save Instrument' command is issued. The only instrument details which require some explanation are 'Last Calibrated' and 'Password Protected'.

'Last Calibrated' allows the user to enter the last calibration date for the instrument. In addition, under certain circumstances (refer to section 7, paragraphs 7.1.2.20 and 7.3.3), this date is updated when an instrument is calibrated by the system. This last calibrated date is used with the Cal Period entry to determine when the instrument is next due for calibration. This information is used mainly by the Inventory Search program for planning of future workloads, refer to paragraph 11.6 for further information.

'Password Protected' allows the user to specify whether the details recalled by the Calibrate program may be edited by the user of the Calibrate program with or without the use of a password. If 'No' is selected, then the only item which requires password entry in the Calibrate program is 'Edit/ Test procedures'.
However if 'Yes' is selected, none of the recalled parameters (including procedure and certificate numbers) may be changed by the user of the calibrate programs without correct entry of the calibrate password.

11.7.2.5 Save Instrument

When all of the instrument details are correctly entered into the Manage - Instrument Entry menu (Fig 11.12), selection of F4 (Save Instrument) will cause the entered details to be saved to the instrument database. If the instrument has been declared as being password protected, then the cursor will flash in the password field, and correct entry of the System Manager password will be required to save this instrument. The message "Instrument Saved Successfully" will be displayed on completion of the save process.

11.7.2.6 Deleting Instruments

If an instrument becomes obsolete or beyond repair and it is appropriate to erase it from the records, this may be done by calling up the instrument details by Serial number or Code number onto the screen, and selecting function key F5 (Delete Instrument) to complete the process.

Correct entry of the System Manager password is required to permit this action and it should be noted that deletion erases any references to past results held by the system either on the hard disk or archived on floppy disks. In other words, all instrument details and pointers to all of its past results are completely and irrevocably erased.

11.8 System Configuration / History

11.8.1 Introduction

The System Configuration and History menus allows the system manager to:

a) Add information to the System History file.
b) Print the information held in the System History file.
c) Configure the Portocal software for operation on a variety of controllers, with a variety of system calibrators, and install optional facilities such as the Tape Backup Unit and the Barcode Reader
d) Install the system calibrators into the Portocal software so that they may be used by the Calibrate program.
e) Update the time and date held on the Ziatech IEEE-488 interface battery-backed clock.

11.8.2 Operation

To gain access to the System Configuration menu, it is necessary to proceed via the System History menu.
From the System Manager menu (Fig 11.2), select F6 (System Config/History) to invoke the System Configuration / History facility. The System History menu (Fig 11.13) will be displayed after correct entry of the System Manager Password.

11.8.3 System History

The System History menu allows the System Manager to insert text and comments into a System History file, which may be added to, saved onto disk and printed out at any time. In addition, the act of installing the calibrators and/or modifying the time and date automatically places an entry to that effect into the System History file. Note that data previously entered into the System History file may not be modified in any way.

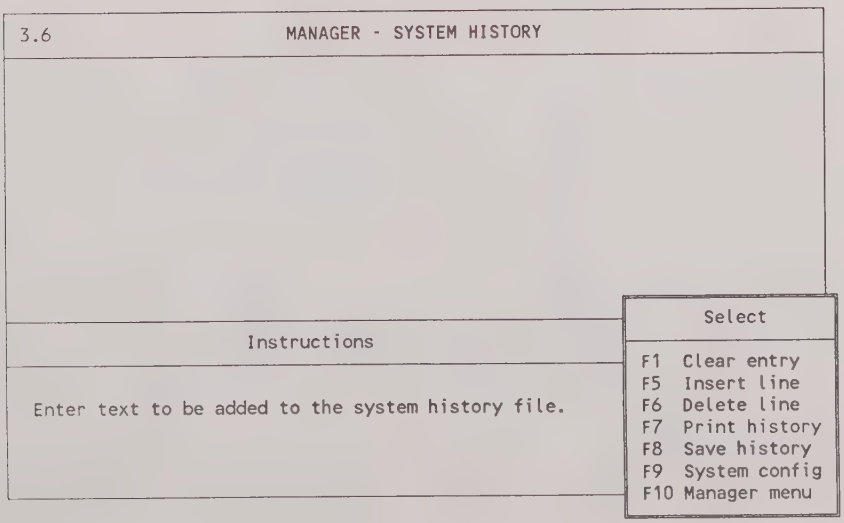


Fig 11.13 Manager - System History Menu

Inside the System History menu, there are several function key choices that perform actions upon the System History file, and several that assist with the editing of a block of text prior to appending to the existing contents of the file.

F1 Clear Entry does not modify the contents of the History file, it merely clears the text field displayed on the screen.

F5 Insert Line does not modify the contents of the History file, it merely inserts a blank line at the current position of the cursor in the text field displayed on the screen.

F6 Delete Line does not modify the contents of the History file, it merely deletes the line at the current position of the cursor in the text field displayed on the screen

F7 Print History initiates a printout of all of the text stored in the History file.

F8 Save History saves the text displayed on the screen into the History file.

Additionally, the text editing facilities detailed in section 5, paragraph 5.2 are available.
From the system History menu (Fig 11.13), selection of F10 (Manager menu) will return the System Manager menu (Fig 11.2) to the screen, while selection of F9 (System Config) will display the System Configuration menu (Fig 11.14)

11.8.4 System Configuration

To display the System Configuration menu (Fig 11.14), select F9 (System Config) from the System History menu (Fig 11.13). This menu allows the System Manager to configure the system to meet a variety of requirements. Note that the inverse video cursor bypasses the Serial Number and Issue fields, these are inaccessible to the user.

11.8.4.1 Calibrator(s)

Depress the function key that corresponds to the type of calibrator(s) to be used in the calibration system. If either a 4000A (DC Standard) or 4200A (AC Standard) is to be used alone, at this point, select the 4000/4200 combination. When the calibrator(s) field is correct, press the ↵ key to proceed to the Computer field.

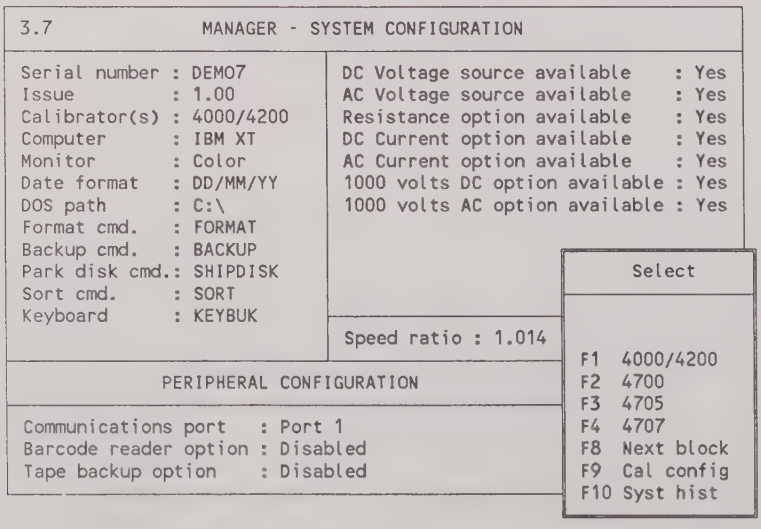

3.7 MANAGER - SYSTEM CONFIGURATION
Serial number : DEMO7
Issue : 1.00
Calibrator(s) : 4000/4200
Computer : IBM XT
Monitor : Color
Date format : DD/MM/YY
DOS path : C:\
Format cmd. : FORMAT
Backup cmd. : BACKUP
Park disk cmd.: SHIPDISK
Sort cmd. : SORT
Keyboard : KEYBUK
DC Voltage source available : Yes
AC Voltage source available : Yes
Resistance option available : Yes
DC Current option available : Yes
AC Current option available : Yes
1000 volts DC option available : Yes
1000 volts AC option available : Yes
Speed ratio : 1.014
PERIPHERAL CONFIGURATION
Communications port : Port 1
Barcode reader option : Disabled
Tape backup option : Disabled
Select
F1 4000/4200
F2 4700
F3 4705
F4 4707
F8 Next block
F9 Cal config
F10 Syst hist

Fig 11.14 Manager - System Configuration Menu

Note that when calibrator(s) of a different type have been installed previously, changing the contents of the field will result in the following:

a) The Certificate Library locations 1 and 2 will be over-written with new versions of the Master IEEE and Master Man certificates (refer to section 10, paragraph 10.1.1) so that these new certificates contain the correct specifications for printing in the System Uncertainties field of a calibration certificate printed with this format.
b) The certificate format held in the temporary file (refer to section 10, paragraph 10.2) is over-written by a copy of the certificate held in the library location 1 (Master IEEE).
c) The 'default' certificate, from which the text for an initialize entry function (refer to section 10, paragraph 10.4.2) is derived is changed to that relevant for the calibrator configuration requested. Therefore, if the user requires to modify the uncertainty field in each of the certificates in the library, all that is required is to recall each certificate in turn, access the System Uncertainty menus (refer to section 10, paragraph 10.5.4), invoke the initialize entry function and save the certificate. From this point, the specification printed on the calibration certificate will reflect the uncertainties applicable to the new system calibrator(s) configuration.

11.8.4.2 Computer

There are three available choices in the select box; F1 (IBM), F2 (HP Vectra) and F3 (Compaq II). It is not possible to enter any other type of computer, not because others are not allowed (although others are not supported by Datron), but as this field affects the way in which the 4101B software displays the different pages of the software. If the computer is not one of the supported models, then select the IBM choice (F1). If, at a later date, the different pages of the 4101B software are presented in an untidy manner, return to this page and select the HP Vectra or Compaq II choices.
When the data in this field is correct, press the ↵ key to proceed to the Monitor field.

11.8.4.3 Monitor

There are two available choices, Color (F1) and Mono (F2). Select F2 for a computer posessing a monochrome display, otherwise select F1. When this information is correct, press the ↵ key to proceed to the Date format field.

11.8.4.4 Date format

The two available format for the display of the date are European format (F1) and American format (F2). When this information is correct, press the ↵ key to proceed to the DOS path field.

11.8.4.5 DOS path

There are no function key choices available for entering data into this field. The data entered in this field will inform the 4101B software where the DOS files that are required for various functions have been installed. If the procedure in section 3, paragraph 3.2.1.3 was followed, the data to be entered is C:\ Note that any character typed in will completely replace any data that was previously entered in this field. If a mistake is made, subsequent use of the backspace key will cause the right hand character to be erased. When the data in this field is correct, press the ↵ key to proceed to the next field.

11.8.4.6 Note for experienced DOS users

The DOS path field informs the 4101B software in which directory the DOS command files for various utilities may be found. At this point, type the directory in which the DOS command files may be found, eg C:\DOS\ Note that multiple paths (eg C:\; C:\DOS\) will cause incorrect operation of the 4101B software.

11.8.4.7 Format cmd.

The data in this field informs the 4101B software the name of the DOS utility used to format a floppy disk. For IBM, HP Vectra and Compaq II, this command is FORMAT. When this is entered correctly, press the ↵ key to proceed to the Backup cmd. field.

11.8.4.8 Backup cmd.

The data in this field informs the 4101B software the name of the DOS utility used to perform a backup onto floppy disk. For IBM, HP Vectra and Compaq II, this command is BACKUP. When this data is entered correctly, press the ↵ key to proceed to the Park disk cmd. field.

11.8.4.9 Park disk cmd.

The data in this field informs the 4101B software the name of the DOS utility used to park the disk prior to relocation of the computer system.

For IBM, enter SHIPDISK

For HP Vectra, this is SETUP

For Compaq II, this should be left blank as the computer comes standard with a self-parking disk.

When this data is entered correctly, press the ↵ key to proceed to the Sort cmd. field.

11.8.4.10 Sort cmd.

The data in this field informs the 4101B software the name of the DOS utility used to perform an alphabetical sort of the data in a file. For IBM, HP Vectra and Compaq II this is SORT. When the data is entered correctly, press the ↵ key to proceed to the Keyboard field.

11.8.4.11 Keyboard.

The data in this field informs the 4101B software the name of the keyboard driver file for the computer used. The possibilities are:

KEYBFR for a French system
KEYBGR for a German system
KEYBIT for an Italian system
KEYBSP for a Spanish system
KEYBUK for a British system
For a US system, this field should be left blank.

Choose the correct keyboard driver file for your system, using the appropriate function key as detailed in the select box, and when the data in this field is entered correctly, press the ↵ key to proceed to the Floppy space field.

11.8.4.12 Sources available.

The data in these fields informs the 4101B software the configuration of the calibrators that will be connected to the computer. Press either F1 (Yes) or F2 (No) for each option and press the ↵ key when the option is correct. A table cross-referencing the calibrator hardware options and the appropriate entries is shown in Table 11.1.

Calibrator	Options	Source options available.
4000A	–	DCV, 1kVDC
4000A	20	DCV, 1kVDC, Ω, DCI
4200A	–	ACV
4200A	10	ACV, 1kVAC
4200A	30	ACV, ACI
4200A	10,30	ACV, 1kVAC, ACI
4707	–	DCV, ACV
4707	17	DCV, ACV, 1kVDC, 1kVAC
4707	27	DCV, ACV, Ω, DCI, ACI
4707	17,27	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI
4700	–	DCV, ACV
4700	10	DCV, ACV, 1kVDC, 1kVAC
4700	20	DCV, ACV, Ω, DCI, ACI
4700	10,20	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI
4705	N/A	DCV, ACV, 1kVDC, 1kVAC, Ω, DCI, ACI

Table 11.1 Sources Available

11.8.4.13 Speed ratio

This field is used to inform the 4101B software of the relative speed of the controller with respect to a standard IBM XT. This is necessary as the Ziatech interface derives its handshake timing from a number of controller-dependent factors. The possibilities are:

F1 (1.000) for an IBM XT
F2 (3.049) for an HP Vectra
F3 (3.036) for a Compaq II
F4 (Test) for the automatic determination of the speed ratio.

To perform the test, first connect a Datron Instruments calibrator to the secondary IEEE port (the calibrator port), and press F4. The message "Speed ratio test in progress" will appear momentarily on the bottom line of the display, and then the number in the highlighted cursor will be modified as applicable. When the data in the field is correct, or a test has been successfully completed, press the ↵ key to continue to the Communication port field.

11.8.4.14 Communications port

This field allows the user to set up the RS-232 port for communications to a remote host or peripheral. If the RS-232 port is not to be used, press the ↵ key to proceed to the Barcode reader option field (paragraph 11.8.4.15).

11.8.4.14.1 Introduction

If the RS-232 communications facilities are to be used, an understanding of the communications capabilities is required before the port setups may be entered.

i) Calibration Procedures and Certificate Formats may be transferred between two controllers that are both running the 4101B software. Procedures and Certificate Formats may not be transferred to a peripheral or a controller that is not running the 4101B software due to the specialized file structures used.

ii) Calibration Results may be sent from a controller running the 4101B software to any remote host or peripheral, as this data is transferred in ASCII format.

iii) The 4101B software is capable of interfacing to a HP 16801A barcode reader, which also uses the RS-232 interface.

When transferring Procedures or Certificate formats, the 4101B software forces the RS-232 setups that are required, so any changes made in the setup page are over-ridden, and re-established when the operation is complete. The setups entered in this page are only active when the 4101B software is sending Calibration Results to a remote host or peripheral.

The cabling required to communicate between two Portocal Systems, and the cabling required to interface the Barcode reader to the Portocal system is detailed in Appendix II.

If it is planned to communicate calibration results to a remote controller or peripheral, these connections may not be valid. In this case, it will be necessary to obtain the RS-232 port pinouts for that equipment.

The barcode reader, which posesses a RS-232 interface, MUST be connected to communications port 1. If the controller posesses twin RS-232 ports, then it is advised that port 2 is used for communications, to eliminate the requirement to change connections. If the computer posesses only one RS-232 port, then it will typically be configured as port 1.

11.8.4.14.2 Enter Communications port setup.

If the RS232 setup is to be examined or modified, then press F3 to enter the Communications Port Setup menu (fig. 11.15). At any point in the page, the depression of the F9 key will cause the setups for that particular port to be reset to defaults values, and the depression of F10 will cause the displayed setups to be saved and the Manager - System Configuration page to return to the screen.

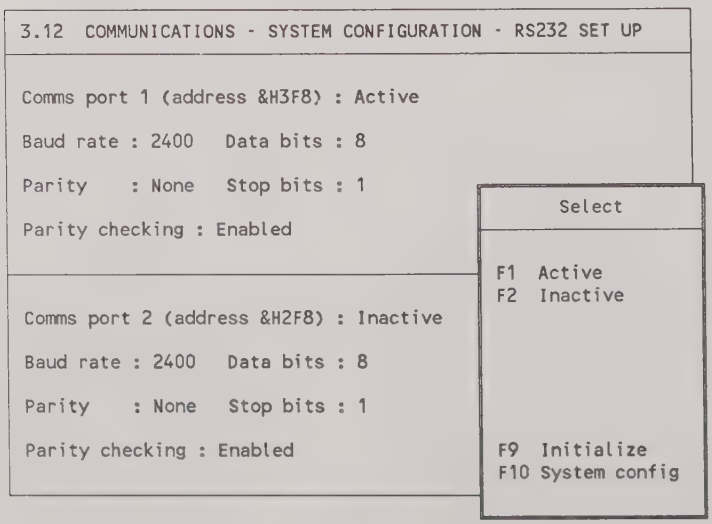

3.12 COMMUNICATIONS - SYSTEM CONFIGURATION - RS232 SET UP
Comms port 1 (address &H3F8) : Active
Baud rate : 2400 Data bits : 8
Parity : None Stop bits : 1
Parity checking : Enabled
Comms port 2 (address &H2F8) : Inactive
Baud rate : 2400 Data bits : 8
Parity : None Stop bits : 1
Parity checking : Enabled
Select
F1 Active
F2 Inactive
F9 Initialize
F10 System config

Fig 11.15 Communication Port Setup Menu

11.8.4.14.3 Comms port 1

This field informs the 4101B software which of the RS-232 ports to use for communications. If there is only one RS-232 connector available on the back of the computer, then port 1 should be enabled (and thus port 2 disabled). If there are two RS-232 ports available, then the user must choose which one will be used for communications.

Press F1 to set the port as active, F2 to set inactive. When the data in this field is entered correctly, press the ↵ key to proceed to the Baud rate field.

11.8.4.14.4 Baud rate

This field informs the 4101B software which baud rate will be used for communication of calibration results to a remote host or peripheral. The possibilities are:

F1 75 baud
F2 110 baud
F3 150 baud
F4 300 baud
F5 1200 baud
F6 2400 baud
F7 4800 baud
F8 9600 baud

When the data entered in this field is correct, press the ↵ key to proceed to the Data bits field.

11.8.4.14.5 Data bits

This field informs the 4101B software on how many data bits are to be used to make up a data word when communicating calibration results to a remote host or peripheral. The possibilities are:

F1 5 bits
F2 6 bits
F3 7 bits
F4 8 bits

When the data in this field is correct, press the ↵ key to proceed to the Parity field.

11.8.4.14.6 Parity

This field informs the 4101B software on whether parity generation and checking is to be active when communicating calibration results to a remote host or peripheral, and if so, whether to generate and check odd or even parity. Press F1 to specify odd parity, F2 for even, or F3 for none. Note that this field cannot be entered if the number of data bits specified is 8, as the possibility of 8 data bits and parity is invalid.
When the data in this field is correct, press the ↵ key to proceed to the Stop bits field.

11.8.4.14.7 Stop bits

This field informs the 4101B software on how many stop bits are to be generated and recognized. Press F1 to select 1 stop bit, F2 to select 2 stop bits. Note that if the number of data bits selected is 5, then the selection of 2 stop bits will actually select 1.5 stop bits. When the data entered in this field is correct, press the ↵ key to proceed to the Parity checking field.

11.8.4.14.8 Parity checking

This field informs the 4101B software on whether or not parity checking is to be enabled or disabled. Press F1 to disable parity checking, press F2 to enable.
When the data entered in this field is correct, press the ↵ key to proceed to the setup of port 2, or press F10 to return to the Manager - System Configuration menu (Fig 3.5).

11.8.4.14.9 Communications Port 2

The settings for port 2 have exactly the same significance as the corresponding settings for port 1.

11.8.4.15 Barcode reader option

This field informs the 4101B software if the barcode reader option is to be used whenever the software is prompting the operator for an instrument's serial number or code number. Select F1 to enable, F2 to disable, ↵ to proceed to the Tape backup option field, or F3 to enter the Barcode Reader setup menu (fig 11.16).

There is no additional information required by the setup page, it merely displays some additional information about the switch settings and connections required by the barcode reader. Note that the bar code reader must be connected to communications port 1.

11.8.4.16 Tape backup option

This field informs the 4101B software if the tape backup option is to be available for the backup of the hard disk. Select F1 to enable, F2 to disable, ↵ to proceed to the Calibrator(s) field, or F3 to enter the setup page (fig. 11.17)
There is no additional information required by the setup page, it merely displays some additional information about the use of the tape backup unit. Select F10 to return to the Manager - System Configuration page (Fig 11.14).

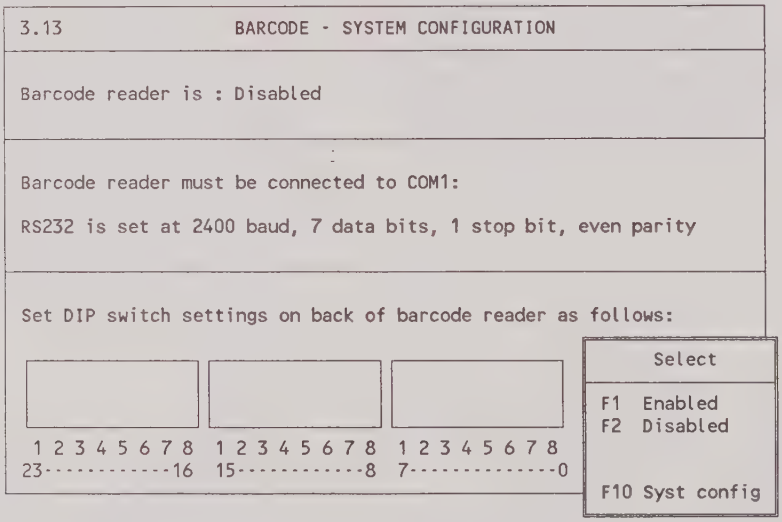

3.13 BARCODE - SYSTEM CONFIGURATION
Barcode reader is : Disabled
Barcode reader must be connected to COM1:
RS232 is set at 2400 baud, 7 data bits, 1 stop bit, even parity
Set DIP switch settings on back of barcode reader as follows:
1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8
23----------16 15----------8 7----------0
Select
F1 Enabled
F2 Disabled
F10 Syst config

Fig 11.16 Barcode Reader Setup Menu

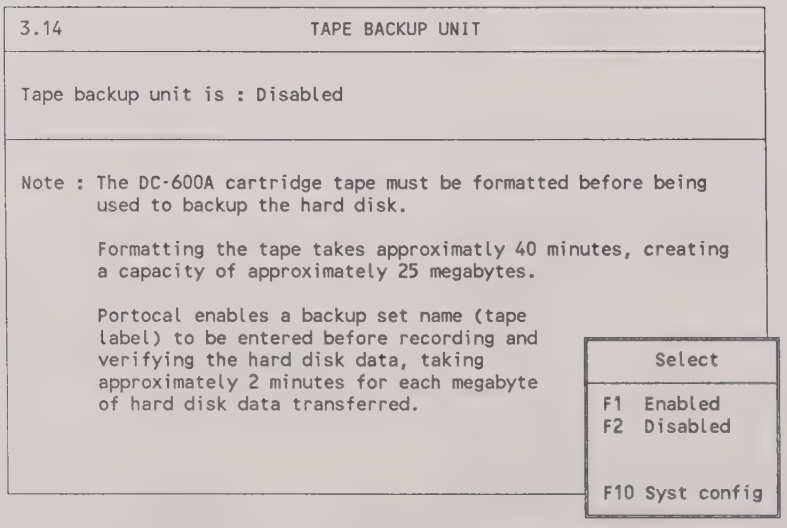

3.14 TAPE BACKUP UNIT
Tape backup unit is : Disabled
Note : The DC-600A cartridge tape must be formatted before being used to backup the hard disk.
Formatting the tape takes approximatly 40 minutes, creating a capacity of approximately 25 megabytes.
Portocal enables a backup set name (tape label) to be entered before recording and verifying the hard disk data, taking approximately 2 minutes for each megabyte of hard disk data transferred.
Select
F1 Enabled
F2 Disabled
F10 Syst config

Fig 11.17 Tape Backup Setup Page

11.9 Installation of the Calibrator(s)

If it is required to install calibrator(s) or to check or modify the time and date stored on the Ziatech interface, then select F9 (Cal config) from the Manager - System Configuration page (Fig 11.14). If the calibrator(s) field has been changed, the system will respond with a message "Please wait - Initialising certificates" while the 4101B software configures itself for the use of the specified calibrator(s).

11.9.1 If no Calibrators are connected

If there is no calibrator connected to the secondary IEEE port, the Calibrator Configuration menu, 11.18 will appear and a message "No calibrator Select F1-Ignor F2-Retry ESC-Abort" will be displayed on the bottom line of the screen. The selection of the F1 key to ignore allows the user to enter the calibrator configuration page, but access is only allowed to the Date and Time fields.
To modify the date, with the highlighted cursor over the date field, type in the correct date in the format that was specified in the Manager - System Configuration page (see paragraph 11.8.4.4). Note that it is not possible to enter an invalid date. When the date is entered correctly, press the ↵ key to proceed to the time field.

To modify the time, with the highlighted cursor over the time field, type in the correct time. When the time entered is correct, press the ↵ key to return to the date field or select the F10 key to return to the Manager - System History menu, Fig 11.13, followed by F10 to resturn to the System Manager menu (Fig 11.2).

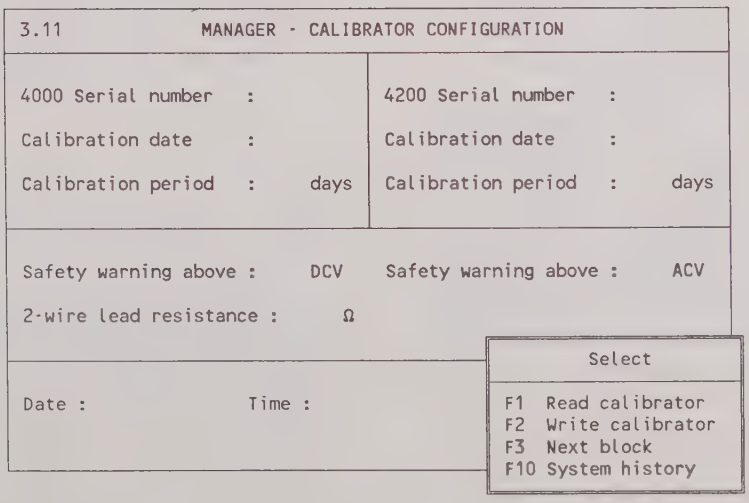


Fig 11.18 Manager - Calibrator Configuration Menu

11.9.2 If Calibrators are connected, and require installation.

On entering the Calibrator Configuration menu, fig. 11.17, the 4101B software reads the serial number(s) from the calibrator(s) and compares this data to the data that is stored on the 4101B database.

a) If the message "XXXX Unrecognized" is displayed, this indicates that the 4101B has read the serial number stores in the calibrator, and has found them to be empty. This will be the response if the calibrator(s) have never been installed in a Portocal before. To rectify this situation, it will be necessary to type the serial number, calibration period, calibration date, safety warning levels and 2-wire lead resistance into the calibrate page and write this information into the calibrator. Refer to paragraph 11.9.3 for the required process.

b) If the message "XXXX Changed" is displayed, this indicates that the 4101B has successfully read the serial number stores in the calibrator, and has found the stored data to be different to that stored on the database. In this case, it will be necessary to read the information stored in the calibrator, and update this information if required. Refer to paragraph 11.9.4 for the required process.

c) If the message "XXXX Out of Cal" is displayed, this indicates that the 4101B has successfully read the serial number stores in the calibrator, and has found that the calibration period, added to the calibration date, falls before today's date. If the calibrator has been recalibrated, it will be necessary to enter the correct calibration date and write this information to the calibrator. Refer to paragraph 11.9.3 for the required process.

d) If the message "151/25092 IEEE Timeout" is displayed, this indicates that the 4101B has detected an instrument in the secondary IEEE-488 port (the calibrator port), but it is not responding in the time interval that the Datron calibrators are designed to do. In this case, it may be that the system Speed Ratio (refer to paragraph 11.8.4.13) has not been set or tested correctly. If this problem persists, it is generally indicative of a faulty calibrator, and it will be necessary to contact either the factory or your local representative for further assistance.

e) If the message "XXXX not at address X" is displayed, this indicates that the 4101B has found that either the address(es) of the calibrator(s) is/are incorrectly set, or that the instrument that has been located at the specified address is not responding as expected. Firstly, to check the IEEE-488 address setting of a Datron calibrator, select the 'Error' key on the front panel of the calibrator, followed by the 'Guard' key, and the address setting will be displayed on the instrument's front panel display.

4000A:	should be at address 4
4200A:	should be at address 8
4707:	should be at address 2
4700:	should be at address 2
4705:	should be at address 2

If the displayed address setting, and the IEEE-488 connections are correct, this will generally be indicative of a faulty calibrator, and it will be necessary to contact the factory or your local representative for further assistance.

11.9.3 If the Calibrator(s) is/are Unrecognized

If the calibrator(s) is/are unrecognized, this indicates that the serial number stores internal to the calibrators are blank. It is necessary to enter the relevant information into the Calibrator Configuration menu and write this information to the calibrator.

11.9.3.1 Serial number

With the highlighted cursor over the Serial number field, type the Serial number of the calibrator, and press the ↵ key when correct. The highlighted cursor will proceed to the Calibration date field.

11.9.3.2 Calibration date

Enter the date when the calibrator was last calibrated, in the same format as specified in the Manager - System configuration page (see paragraph 11.8.4.4). Press the ↵ key when when the entered date is correct, and proceed to the calibration period field.

11.9.3.3 Calibration period

Enter the calibration period to which the calibration system is to work to and press the ↵ key when the entered period is correct.

11.9.3.4 Multiple calibrators.

If the calibrators specified in the Manager - System configuration page (paragraph 11.8.4.1) are the 4000A/4200A combination, then the serial number, calibration date and calibration period must also be entered into the correct field for the 4200.

11.9.3.5 Safety warning levels

The Safety warning above field allows the user to specify that audible and visual warnings are to be presented to an operator whenever the outputs from the calibrator(s) reach a dangerous level. The left hand warning level is that for DC voltages, the right hand for AC. The preset limits of 110V DC and 75V AC may be reduced at this point, but may not be increased.

Enter the safety levels above which warnings are to be presented to the operator. Press the ↵ key when the levels are set correctly.

11.9.3.6 2-wire lead resistance

When calibrating an instrument-under-test which has only a 2-wire resistance measurement capability, it is necessary to add the resistance of the leads to the value of the applied resistance to achieve the value of the resistance applied at the input terminals of the instrument-under-test.

To measure this resistance, perform the following measurements with a high accuracy DMM such as a Datron Instruments 1081 Autocal DMM.

Step 1: Calibrator setting:
Resistance function, 1Ω (4000A) or 10Ω (47XX) range, 0Ω output setting, remote sense, output on.

DMM setting:
Resistance function, lowest resistance range (10Ω for the 1081), 4-wire measurement.

Connections:
4-wire configuration from the calibrator to the DMM. Perform an input zero on the DMM.

Step 2: Calibrator setting:
Turn the output off, select local sense and turn the output on.

DMM setting:
Change to 2-wire measurement function.

Connections:
Remove the I+ and I- leads from the DMM input terminals.

Note the reading on the front panel of the DMM, and subtract the internal 2-wire lead resistance as displayed on the front panel of the calibrator. Enter this value into the 2-wire lead resistance field and press the ↵ key when correct.

11.9.3.7 Date

To modify the date, with the highlighted cursor over the date field, type in the correct date in the format that was specified in the Manager - System Configuration page (see paragraph 11.8.4.4). Note that it is not possible to enter an invalid date. When the date is entered correctly, press the ↵ key to proceed to the time field.

11.9.3.8 Time

To modify the time, with the highlighted cursor over the time field, type in the correct time. When the time entered is correct, press the ↵ key to proceed to the serial number field.

11.9.3.9 Write to the calibrator(s)

When a calibration procedure is initiated by the operator, the 4101B software will read the calibrator serial number, calibration date and calibration period from the calibrator(s). These must match the data that is stored on the database, therefore it is necessary to enter this information into the calibrator(s).
The message "Set calibration key to ENABLE on 4XXX Select F1-Cont ESC-Abort" will appear on the bottom line of the screen.
Insert a calibration key in the keyswitch on the rear panel of the calibrator and press F1 when set to Cal. The message "Writing to calibrator" will appear for a short time, and then the prompt "Set calibration key to RUN on 4XXX Select F1-Cont" requests that the calibrator be set back to run mode.

11.9.3.10 Reading resistance values.

The message "Reading resistance values" will appear if the calibrator concerned is a 4000A, 4707, 4700 or 4705. These are the calibrated resistance values that will be applied whenever a resistance is called up during a calibration procedure, and will be stored on the database.

11.9.3.11 Repeating for 4200A

If the calibrator configuration is a 4000A/4200A pair, then this process must be repeated for the 4200. This is accomplished by moving the highlighted cursor, using the ↵ key or the F3 key (next block) until it is over the 4200 serial number, calibration date or calibration period fields. Press the F2 key to initiate the write to calibrator sequence (paragraph 11.9.3.9)

11.9.4 If the Calibrator(s) is/are Changed

If the serial number stores internal to the calibrator(s) contain the correct data (as opposed to being blank), then reading the calibrator is sufficient to install it into the 4101B database. With the highlighted cursor over the Serial number, Calibration date or Calibration period fields, press the F1 key to initiate the read action. The serial number, calibration date and calibration period data will be read from the calibrator and stored on the database. A few seconds later, the message "Reading resistance values" will appear if the calibrator concerned is a 4000A, 4707, 4700 or 4705. These are the calibrated resistance values that will be applied whenever a resistance is called up during a calibration procedure, and will be stored on the database.

11.10 Define Universal Titles

11.10.1 Introduction

The Manager - Define Universal Titles menu allow the System Manager to:

i) Modify certain words and expressions used on the calibration certificate and the various menu displays used on all programs to be altered to suit the user's taste in terminology. For example, the words 'Code Number' used in all programs could be changed to 'Asset Number'. Any consequent reference to what was referred to as Code Number will now be referred to as Asset Number.

ii) It allows the 3 different passwords used by the system to be defined and altered as and when required.

11.10.2 Operation

Selecting function key F7 (Define Universal Titles) from the system Manager Menu (Fig 11.2) will, after correct entry of the System Manager password, display the Manager - Define Universal Titles menu (Fig 11.19).

The titles listed in the upper portion of the menu may be altered, with the aid of the F1(Clear entry), F2 (Initialize entry), F3 (Next Block) and F4 (Next Entry) function keys, causing all displays and printouts to follow suit where appropriate, throughout the whole software suite. The initialize entry function may be used to recall the original titles that were in effect when the system was first installed.

The passwords displayed in the lower portion of the screen may be modified similarly. There are some restrictions, however. The password field will accept only characters between A and Z, in upper case, and there must be at least six characters in each. Note that at installation, all passwords are preset to DATRON.

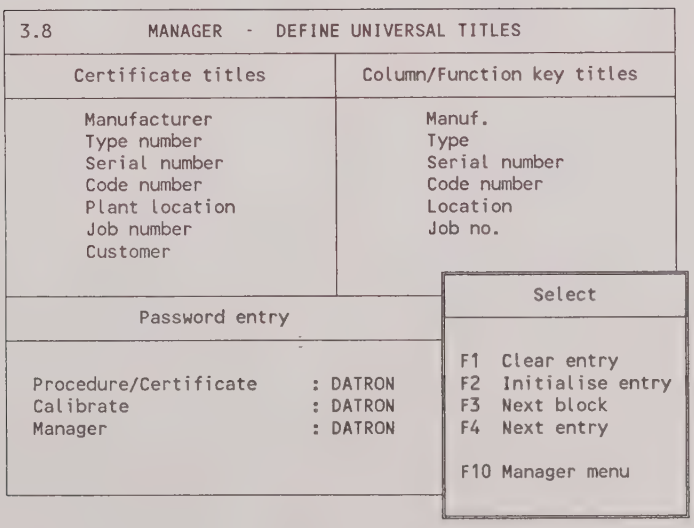


Fig 11.19 Manager - Define Universal Titles Menu

SECTION 12: THE SOFTWARE FRONT PANEL

12.1 Introduction

The software front panel facility enables the user to remotely control the system calibrator(s) over the IEEE-488 interface bus, without the requirement transmitting individual bus commands. This is a particularly useful facility in the situation where the system calibrator(s) are mounted in a 4102 or 4112 Calibration Cart, and the user wishes to set up a specific output value without the need to open the door of the cart and take manual control of the calibrator.

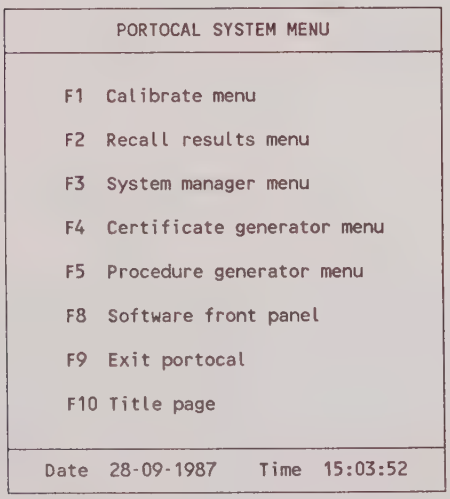


Fig 12.1 Portocal System Menu

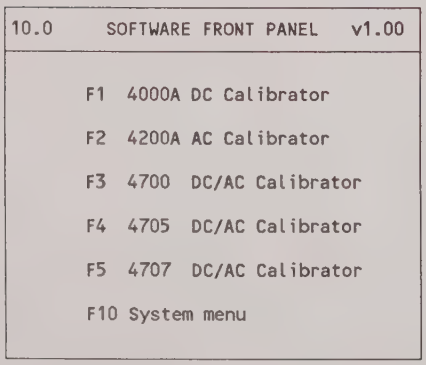

10.0 SOFTWARE FRONT PANEL v1.00
F1 4000A DC Calibrator
F2 4200A AC Calibrator
F3 4700 DC/AC Calibrator
F4 4705 DC/AC Calibrator
F5 4707 DC/AC Calibrator
F10 System menu

Fig 12.2 Software Front Panel Menu

12.2 Operation

From the system Manager Menu (Fig 12.1) select F8 to display the Software Front Panel menu.(Fig 12.2). This menu offers the choices of:

F1 4000A DC Calibrator.
F2 4200A AC Calibrator.
F3 4700 DC/AC Calibrator.
F4 4705 DC/AC Calibrator.
F5 4707 DC/AC Calibrator.
F10 System Menu.

Note that:

a) The system calibrator(s) must be configured in the same way as with the remainder of the Portocal software. The IEEE-488 addresses of the 4000A must be set at 4, the 4200A at 8, and the 4700, 4705 and 4707 at address 2.

b) The calibrator(s) must be connected to the secondary IEEE-488 interface (looking at the read panel of the controller, the secondary port is the one on the left).

c) If unfamiliar with the manual operation of the calibrator(s), the user should first refer to the User's Handbooks for the individual calibrator(s).

The following process illustrates the use of the Software Front Panel facility for the 4707 Multi-function Calibrator. The principles of operation for the remaining calibrators is identical, except for the hardware limitations of the calibrators themselves. For example, the 4000A calibrator does not possess an AC Voltage capability.

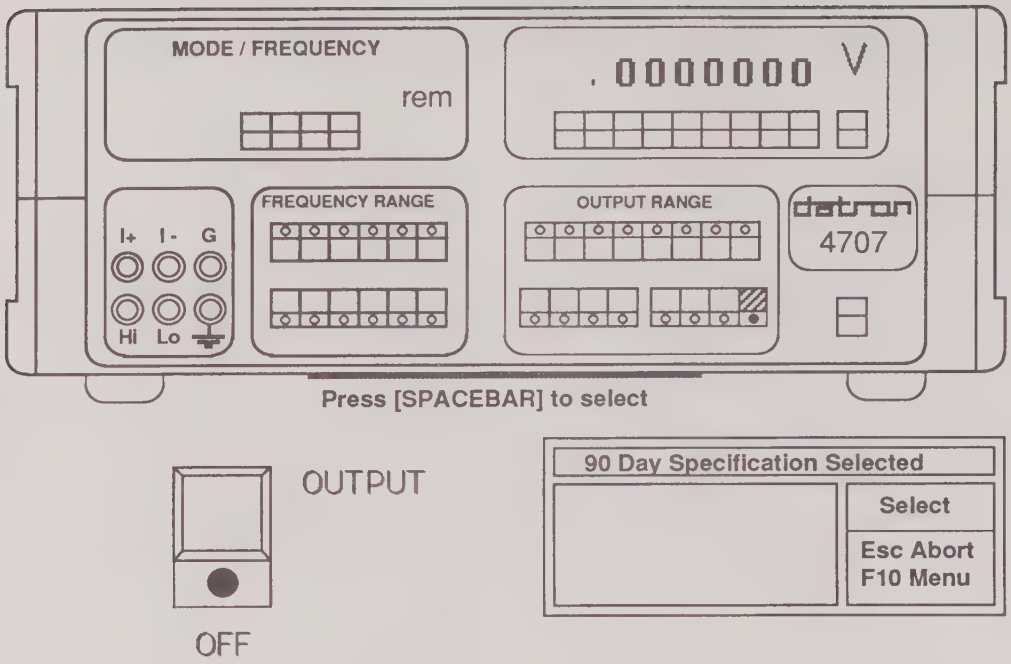


Fig 12.3 The Software Front Panel

12.2.1 Initial Conditions.

From the Software Front Panel menu (Fig 12.2), selection of F5 (4707 DC/AC Calibrator) will display the Software Front Panel (Fig 12.3), which is a graphical representation of the front panel of the 4707 calibrator. Note that an enlarged Output key is presented in the lower left hand corner of the screen, the location of the Output key on the front panel of the calibrator is highlighted and the output value is set to 0V. This is the default power up state for the 4707 calibrator.
The Select window in the lower right corner of the screen offers the choice of Esc to Abort and F10 to return to the Software Front Panel menu (Fig 12.2)

12.2.2 Key Selection and Operation.

The calibrator may be programmed by moving the highlighted cursor (green on a color monitor) with the ↑ , ↓ , ← , and → cursor control keys situated on the numeric keypad on the right of the keyboard (not that Num Lock must be off). Note that as the cursor moves from key to key on the frony panel of the calibrator, an enlarged representation of that key, along with its function, is presented in the lower left corner of the screen. To invoke the corresponding action of that key on the calibrator's front panel, depress either the spacebar or the ↵ key.

12.2.3 Non-Functioning Keys.

The following Software Front Panel 'keys' do not function:

4000A: Any of the ⇑ and ⇓ keys in the upper left hand corner.
The Safety Reset key.
The Test key
The Offset key
The Error key

4200A: The Safety Reset key.
The Test key.
The Error key.

4700, 4705, 4707:
Any of the ⇑ and ⇓ keys in the upper left hand corner (when in a DC function).
Any of the Frequency Range keys (when in a DC function).
The Safety Reset key.
The Test key.
The Offset key.
The Error key.

Note that if one of these keys is invoked while the Software Front Panel facility is operative, this will result in control of the calibrator being passed to the front panel keys (a Go To Local command is sent).

12.2.4 Spec Readout.

On entry to the screen of Fig 12.3, the select window in the lower left corner displays the legend "90 Day Specification Selected". This indicates that if the highlighted cursor is placed over the 'Spec' key (to invoke the Specification Readout function), the 90 day specifications of the calibrator will be displayed in the left hand display of the calibrator fron panel displayed on the screen.
At this point, the Software Front Panel will also allow the user to select which specifications are displayed.
Select F4 to display the 24 hour specifications,
Select F6 to display the 90 day specifications,
Select F8 to select the 1 year specifications.

SECTION 13: 4100 SPECIFICATION VERIFICATION

13.1 Introduction

This section deals with user-verification of the 4100 performance to specification. It should be carried out as two independant verifications: DC specification and then AC specification.

13.1.1 Terminology

Hereafter, the 4000/4000A, 4200/4200A, 4700, 4705 and 4707 calibrators will be referred to as 'the calibrator', and the lead kit used (be it the leads incorporated in the 4102 and 4112 calibration carts or the PLK-1 or PLK-2 lead kits) will be referred to as 'the Portocal leads'.

13.1.2 Specifications

The specifications applicable to the 4100 Calibration system are derived from the specifications for the relevant Calibrator, with the uncertainties listed in Table 13.1 added. The specifications for the Calibrators may be found by referring to Section 7 of the applicable User's Handbook.

Note that these specifications are only applicable to a system utilizing either the lead kit supplied with the 4102/4112 Calibration Cart, or a PLK-1/PLK-2 setup. If the system is being used with a different lead setup, these additional specifications are not applicable.

SYSTEM ANALOG PERFORMANCE:

To specify performance at the remote end of the analog lead assembly (either the Datron 4102/4112 carts or the Datron PLK-1 and PLK-2 lead kits), add the following uncertainties to the specifications of the calibrator used in the system:

FUNCTION	RANGE	FREQUENCY	ADDITIONAL UNCERTAINTIES
DCV:			No additions required
ACV:	1mV 10mV 100mV 1V 10V	100kHz to 1MHz 100kHz to 1MHz 100kHz to 1MHz 300kHz to 1MHz 300kHz to 1MHz	2%R + 3%FS (typical). 2%R + 3%FS (typical). 2%R + 3%FS (typical). 0.3%R + 0.1%FS 0.3%R + 0.1%FS
RESISTANCE	1MΩ 10MΩ 100MΩ		10ppmR 100ppmR 1000ppmR
DCI:			No additions required.
ACI:			No additions required.

Table 13.1 System Analog Performance.

13.2 DC Specification Verification

13.2.1 Verification upon receipt of a 4100 System

Each calibrator leaving the factory is calibrated to its nominal values in DC voltage, DC current, and to actual values in Resistance. The Accuracy specifications can be made relative (ie. Traceable) to national standards by the addition of Datron's Calibration Uncertainty figures quoted in the specifications printed in section 7 of the appropriate User's manual.

13.2.2 Equipment Requirements

For DC Voltage:

A DC Voltage Standard of suitable accuracy.
Example: Series bank of 10 standard cells and Datron 4904 Standard Cell Buffer.

A Precision Divider.
Example: Datron 4902 High Voltage Divider and Datron 4903 DC Switching Unit.

A battery operated null detector with variable sensitivity, able to withstand 1200V across its input terminals.
Example: Keithly Instruments Model 155.

For DC Current:

A set of calibrated current shunts of suitable accuracy.

A highly stable DMM, recently standardized on the 100mVDC and 1VDC ranges.
Example: Datron 1081

CAUTION: When choosing a set of current shunts ensure that their power dissipation ratings are sufficient to avoid permanent degradation from the self-heating effects of the current being checked. This applies particularly to the 1 Amp shunt.

For Resistance:

A set of standard resistors covering 1Ω to 10MΩ. The 1Ω to 10kΩ should be 4-wire type.

A highly-stable resistance-measuring DMM, or other resistance measuring system, to be used as a transfer measurement device.
Example: Datron 1081

13.2.3 Notes on the Use of the Null Detector

The null detector is connected in the Hi lead between the DC voltage source and the calibrator. A high input impedance device should be chosen to reduce off-null currents due to the differences in the outputs of the DC voltage source and the calibrator. A battery operated instrument is preferred to ensure adequate isolation. Some null detectors possess high input impedance only when their readings are on-scale, so care should be taken to ensure that drain currents from the DC voltage source do not become excessive. This applies particularly if the DC source is a standard cell or a bank of cells.

1. The null detector should be connected to the calibrator only when the calibrator output is OFF.

2. Always set the null detector to its lowest sensitivity before connecting up, and increase sensitivity only when the voltages output by the DC voltage source and the calibrator are close in value.

3. Do not change polarity of the calibrator or DC voltage source without first switching the calibrator output OFF. Care must be taken to ensure that the correct polarity calibrator ON key is pressed, to avoid excessive voltages being connected across the null detector, particularly when checking the calibrator directly against a standard cell.

4. **WARNING:** During performance checks and calibration the full range voltage is present at the divider input terminals. On ±1000V checks this voltage is potentially lethal, so **EXTREME CAUTION** must be observed.

5. **CAUTION:** The null detector used must be able to withstand voltages up to 1200V between its input terminals. Such voltages will be present during the time that the calibrator is ramping from zero to 1000V full range after setting output ON.

6. Most Null Detectors are equipped with a 'Self-zero' or 'Zero-check' facility. For maximum accuracy, the Null Detector range zero should be checked before each nulling operation is performed. However, when verifying the calibrator output ranges, the zero offset of the DC Standard voltage source is nullified by adjustment of the Null Detector zero control. This setting should not be altered until the corresponding range gain has been verified.

13.2.4 Specification Verification Report Sheet

A Report Sheet (RS1) is provided later (pages 13-10 and 13-11) which may be used for recording the results of verifying the specifications. The sheet may be used as a master to generate duplicate copies for future use.

13.2.5 Non-Verification

If a system is found to be out of specification, refer to the Calibration process, Section 14, or contact your nearest Datron Servicing Center.

13.2.6 Verification Procedures

A full verification should be carried out in the sequence appearing on the Specification Verification Report Sheet RS1. The instructions which follow are divided into four procedures:

a) DC voltage full range
b) DC voltage linearity (10V range only)
c) DC current full range
d) Resistance

The displayed limits do not include temperature coefficient corrections or the user's calibration uncertainties which should be taken into account if this is appropriate.

CAUTION: First read the notes on the use of the null detector (paragraph 13.2.3).

13.2.7 DC Voltage Full Range

1. Turn the 4100 system on and allow a minimum of 4 hours to warm- up in the specified environment.

2. Open the front door of the 4102/4112 calibration cart, if applicable, so that access to the calibrator's front panel may be obtained.

3. Cancel any MODE keys, set output OFF and check that the **cal** legend is not present on the MODE display.

4. Select DC and connect the DC voltage source and null detector to the calibrator Hi and Lo lead as shown in Figures 13.1, 13.2 or 13.3, depending on the range being verified. Note that the lead setup used should be the one which requires verification.

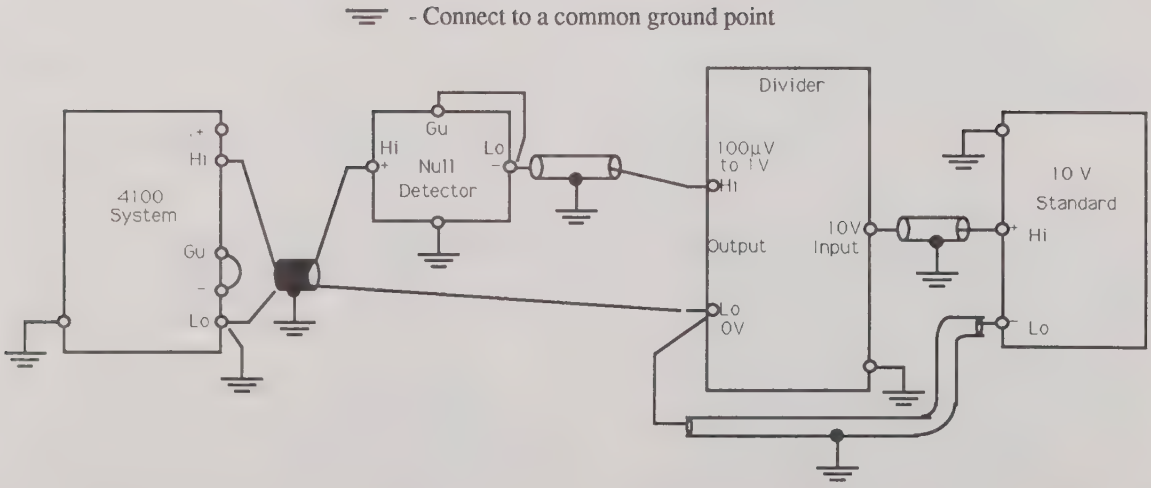


Fig 13.1 DC Voltage Verification Connections (100µV to 1V Ranges)

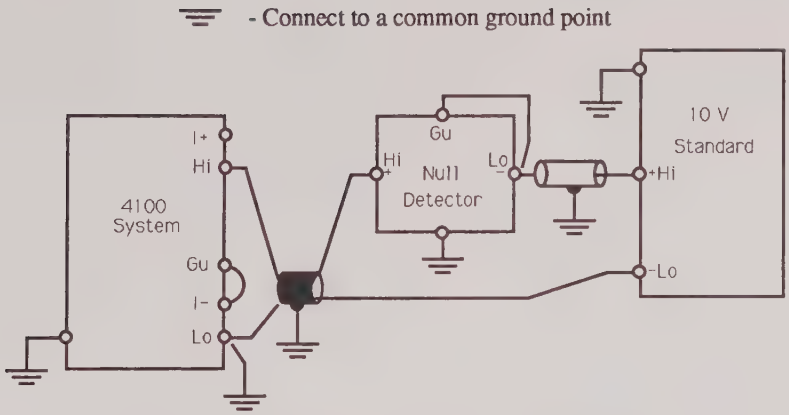


Fig 13.2 DC Voltage Verification Connections (10V Range)

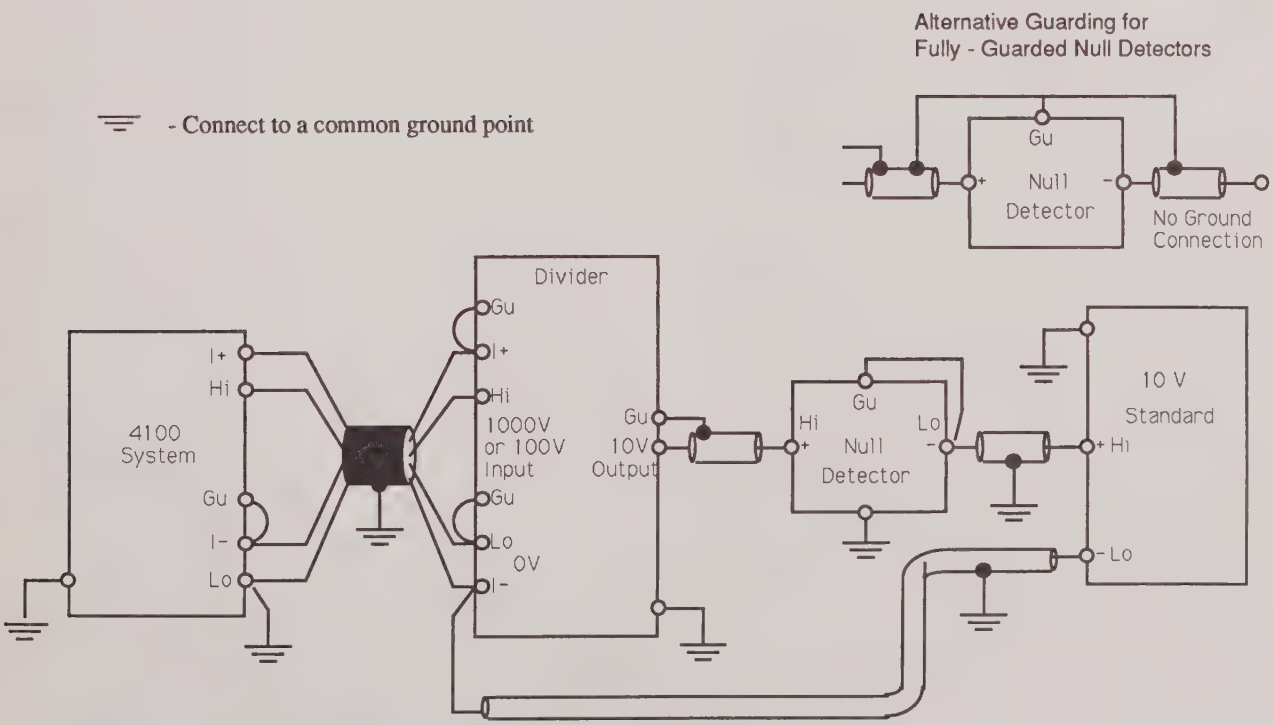


Fig 13.1 DC Voltage Verification Connections (100V and 1kV Ranges)

5. Full Range Checks: To check each value against specification limits use the following routine:

(a) Null detector: Set to low sensitivity.

(b) Calibrator: Switch output OFF.

(c) DC voltage source: Set to correct polarity and to a voltage close to the full range value. Note this value on Report Sheet RS1 under the column 'DC Calibration Source Voltage'. From this value, compute the High and Low specification limits from Formula-I (refer to paragraph 13.4.1). Record these limits in the appropriate columns of Report Sheet RS1.

(d) Calibrator: Select DC and correct range.

(e) Calibrator: Use OUTPUT ⇑ and ⇓ keys to set correct polarity and voltage on the OUTPUT display.

(f) Calibrator: Press the correct polarity ON key. **CAUTION:** Pressing the wrong ON key will result in approximately twice the output voltage being connected across the null detector.

(g) Null detector: Increase sensitivity to give an off null reading and use the calibrator OUTPUT ⇑ and ⇓ keys to to back off to null, until the null lies between two consecutive values of the OUTPUT display least significant digit.

(h) Calibrator: Record the OUTPUT display value closest to null on Report Sheet RS1 and check against the specification limits.

13.2.8 DC Linearity

This is performed on the 10V range. Check each pair of values shown on Report Sheet RS1 in the following order to reduce stabilization time for thermal effects at the terminals:

±10mV, ±100mV, ±1V, ±10V, ±19V.

The checks may be carried out at the above values or at the user's reference standard voltages close to the above values.

13.2.9 DC Current

1. If the DC Voltage checks have not been performed, it will be necessary to follow steps 1, 2 and 3 of paragraph 13.2.7.

2. Select DC and I on the Calibrator front panel and connect the DMM and calibrated current shunt to the 4100 System I+ and I- leads as shown in Figure 13.4.

   Preferred shunt values are as follows:
   100μA range - 10kΩ - 1mW min
   1mA range - 1kΩ - 10mW min
   10mA range - 100Ω - 100mW min
   100mA range - 10Ω - 1W min
   1A range - 1Ω - 10W min

   A voltage of 1V now represents full range values of 4000A ouput current.

3. Full range checks: to check each value against its specification limits use the following routine:

   (a) Calibrator: Switch output OFF.

   (b) DMM: Select DCV function and appropriate range. Connect across the selected shunt.

   (c) Calibrator: Select I and range on the front panel.

   (d) Calibrator: Use OUTPUT ⇑ and ⇓keys to set correct polarity and current on the OUTPUT display. Press the correct polarity ON key and allow a suitable time to stabilize.

   (e) DMM: Measure the voltage across the shunt and record this value in the appropriate column of Report Sheet RS1.

   (f) Calibrator: Record the OUTPUT display value on Report Sheet RS1 and check against the specification limits which can be computed from Formula-II (refer to paragraph 13.4.3).

   (l) Calibrator: Switch output OFF.

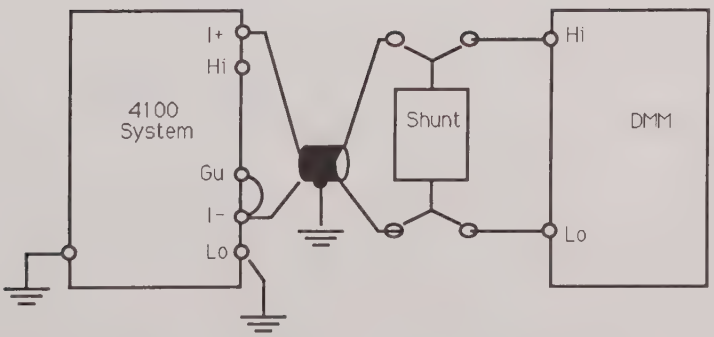


Fig 13.4 DC Current Verification Connections

13.2.10 Resistance Checks

The calibrator supplying the DC function in the 4100 system can provide both 2-wire and 4-wire resistance values. When operating in 2-wire the calibrator will display the sum of the value of the internal precision resistor and the internal wiring resistance which connects the precision resistor to the terminals. (In 4-wire the internal wiring effects can be ignored).

When the calibrator is being used as part of a 4100 system, 2-wire measurements need to also take into account the resistance of the 4100 lead kit. Provision is made for this through the 4101 software package which allows an operator to enter (via the Manager-System Configuration Menu) the measured resistance of the 4100 lead setup used. When the calibration program system is running, the software automatically takes this lead resistance into account for any 2-wire measurements.

This lead resistance must be measured if the performance of the 4100 system (including its lead kit) is to be verified.

For the method of determining this additional lead resistance, refer to Section 11, paragraph 11.9.3.6 and enter this value in the 4100 Lead Resistance column of Report Sheet RS1.

13.2.11 Full Range and Zero Checks

1. Carry out the DC voltage performance checks 1 to 3 if the DC voltage performance has not been verified.

2. For each resistance range selection, three checks are required:

   (a) Remote Sense (4-wire) at full range (resistor value).

   (b) Local Sense (2-wire) at full range (resistor plus internal wiring and lead resistance).

   (c) Local Sense (2-wire) at zero (internal wiring and lead resistance only).

3. It is assumed that the specified energizing currents will be used to verify the resistance specification, so the displayed limits have been calculated directly from the specification figures in Section 7 of the User's Handbook for the calibrator, and are not modified by accuracy derating factors.

   Carry out the checks in the order listed in Report Sheet RS1, to minimize waiting time for thermal stabilization.

4. Perform each check in the following order:

   (a) Calibrator: Set output OFF.

   (b) Calibrator: Select resistor value range key. Record the value of the calibrator resistor on Report Sheet RS1 under the column 'Displayed Value'. From this value, compute the High and Low specification limits from Formula-III (refer to paragraph 13.4.4). Record these limits in the appropriate columns of the Report Sheet RS1.

   (c) Calibrator: Select Local/Remote Sense as required. Output must be OFF.

(d) DMM: Connect standardized DMM (ie. the DMM should have just been calibrated against the set of standard resistors) using 4100 lead. (2-wire to Hi and Lo leads, or 4-wire energizing current to I+ and I- terminals).

(e) Calibrator: Set output ON.

(f) DMM: Record DMM reading ('Measured Value') and compare against the specifications in Report Sheet RS1.

4100 VERIFICATION REPORT SHEET. RS1

(Use as master for duplicate copies)

Serial Number_____ Date_____

Checked by _____ Company/Dept. _____

1. DC Voltage Full Range Checks

Polarity / Range	DC Calibration Source Voltage	Specification Limits		OUTPUT Display Reading for Null
		High	Low	
+ 100µV				
- 100µV				
+ 1mV				
- 1mV				
+ 10mV				
- 10mV				
+ 100mV				
- 100mV				
+ 1V				
- 1V				
+ 10V				
- 10V				
+ 100V				
- 100V				
+ 1kV				
- 1kV				

2. DC Voltage 10V Range Linearity

Polarity / Range	DC Calibration Source Voltage	Specification Limits		OUTPUT Display Reading for Null
		High	Low	
+ 10mV				
- 10mV				
+ 100mV				
- 100mV				
+ 1V				
- 1V				
+ 10V				
- 10V				
+ 13V				
- 13V				

3. DC Current Full Range Checks

Polarity / Range	Output Setting	Specification Limits		DMM Reading
		High	Low	
+ 100µA				
- 100µA				
+ 1mA				
- 1mA				
+ 10mA				
- 10mA				
+ 100mA				
- 100mA				
+ 1A				
- 1A				

4. Resistance Checks: Note that the 100MΩ Range is applicable to 4700, 4705 and 4707 Calibrators only, while the 1Ω Range is applicable to 4000 and 4000A calibrators.

Polarity / Sense		Specified Current	Current Used	Displayed Value	4100 Lead Resistance	Specification Limits		Measured Value
						High	Low	
100MΩ	Remote	1µA						
	Local	1µA						
10MΩ	Remote	1µA						
	Local	1µA						
1MΩ	Remote	10µA						
	Local	10µA						
100kΩ	Remote	100µA						
	Local	100µA						
10kΩ	Remote	100µA						
	Local	100µA						
1kΩ	Remote	1mA						
	Local	1mA						
100Ω	Remote	10mA						
	Local	10mA						
10Ω	Remote	10mA						
	Local	10mA						
1Ω	Remote	100mA						
	Local	100mA						

13.3 AC Specification Verification

13.3.1 Introduction

The most common method of verifying AC voltage outputs is to check against an accurate DC voltage standard via a Thermal Transfer. However, available thermal transfer standards are not suitable for direct verification of millivolt ranges, because their transfer elements are insufficiently sensitive.

Furthermore, as this verification section is intended to prove the performance of the entire 4100 system (including the lead kit), none of the AC ranges can be compared directly against a thermal transfer standard. This is because the lead kit is constructed to optimize the performance of the system when connected to a typical DMM (ie. high impedance) load. As thermal transfer standards are generally low impedance devices they tend to draw higher currents down the output leads, which at higher frequencies can lead to significant cross-coupling errors.

The 4100's AC performance can be split into two components:

(i) The basic performance of the calibrator.

(ii) The effect of the 4100 lead assembly on (i).

The recommended verification method invoves proving (i) using the methods described in the calibrator's User's Handbook, Section 7, and then measuring (ii) using the methods outlined later in this section. The addition of the lead errors to those errors measured in the calibrator when in isolation gives the total error associated with the system.

This section describes how to measure the 4100 lead errors. In general the approach is to standardize a DMM directly against the calibrator used in the 4100 sytem, using the leads that were used to calibrate the calibrator , and then take a set of measurements with the DMM of the 4100 system through the system lead kit. The comparison of these two sets of measurements will give the additional errors due to the lead kit.

13.3.2 Equipment Requirements

AC Voltage: A stable AC voltage measuring DMM. Example: Datron 1081 or 1071.

AC Current: A stable AC current measuring DMM. Example: Datron 1071.

13.3.3 Specification Verification Report Sheet

A Report Sheet (RS2) is provided on pages 13-18 and 13-19 which can be used for recording the results of verifying the specifications. The sheet may be used as a master to generate duplicate copies for future use.

13.3.4 Non-Verification

If a system is found to be out of specification, refer to Section 14, which describes the calibration process, or contact your nearest Datron Servicing Center.

13.3.5 Verification Procedures

A full verification should be carried out in the sequence appearing on the Specification Verification Report Sheet RS2. The instructions which follow are divided into four procedures:

a) AC voltage full range
b) AC mV HF verification
c) AC voltage linearity (10V range only)
d) AC current full range

The displayed limits do not include temperature coefficient corrections or the user's calibration uncertainties which should be taken into account if this is appropriate.

13.3.6 Introduction

1. Turn the 4100 system on and allow a minimum of 4 hours to warm-up in the specified environment.

2. If appropriate, open the front door of the 4102/4112 calibration cart so that access to the calibrator's front panel can be obtained.

3. Cancel any MODE keys, set output OFF and check that the **cal** legend is not present on the MODE display.

4. Remove the terminal connection box of the 4100 lead kit, exposing the terminals of the calibrator.

5. Verify the performance of the calibrator AC voltage function using the methods described in the calibrator User's Handbook, Section 7.

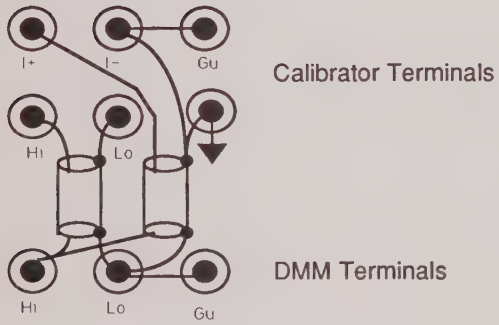


Fig 13.4 4 - Wire Connections (1V to 1kV Ranges)

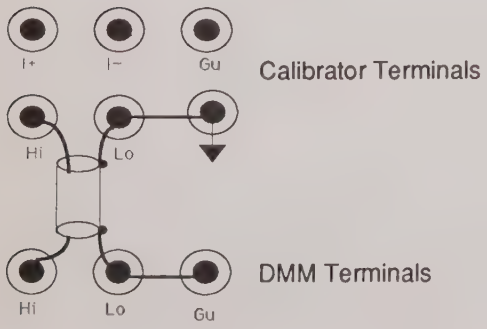


Fig 13.5 2 - Wire Connections (mV Ranges)

13.3.7 Full Range Checks

To check each value against specification limits use the following routine:

(a) Connect the DMM's AC measurement circuits to the calibrator output terminals as shown in Figures 13.4 and 13.5. Use the type of leads which are normally used for the calibration of the calibrator (eg. short lengths of coaxial cable).

NOTE: The only exceptions to these configurations are the mV HF checks at 1MHz on the 100mV, 10mV, and 1mV ranges. Refer to paragraph 13.3.8 for Millivolt HF Verification.

(b) Calibrator: Switch output OFF.

(c) DMM: Set to correct function and range.

(d) Calibrator: Select V and correct voltage and frequency ranges. Remote Sense should be used for 1V to 1000V ranges and Local Sense for the mV ranges.

(e) Calibrator: Use OUTPUT ⇑ and ⇓ keys to set correct voltage on the OUTPUT display, and correct frequency on FREQUENCY display.

(f) Calibrator: Press the ON key.

(g) DMM: Record the DMM reading and note it on Report Sheet RS2. (Calibrator reading column).

(h) Turn the calibrator output OFF, disconnect the leads from the terminals and replace the 4100 terminal connection box onto the calibrator's terminals. For a 4000A / 4200A setup, ensure that the 4200 Ground terminal is connected to Guard using the switch provided on the 4200 terminal connection box. For a 4700, 4705 or 4707 calibrator, connect the Ground terminal to Guard. Then connect the 4100 lead to the DMM as follows:

4-Wire (1V to 1000V ranges): Hi and I+ leads to DMM Hi terminal. Lo and I- leads to DMM Lo terminal. Guard lead to DMM Guard terminal.

2-Wire (mV ranges): Hi lead to DMM Hi terminal. Lo lead to DMM Lo terminal. Guard lead to DMM Guard terminal.

(j) Calibrator: Press the ON key.

(k) DMM: Record the DMM reading and note it on Report Sheet RS2. (4100 Reading column).

(l) Calibrator: Turn the output OFF. Remove the 4100 terminal connection box

(m) Repeat the sequence from 6(a) to 6(l) for all the voltage settings specified in Report Sheet RS2. Compare the results with the High and Low Specification Limits computed from Formula-IV (refer to paragraph 13.4.5).

13.3.8 Millivolt Range HF Verification

Section 14 describes how to calibrate the millivolt ranges at HF directly using the 4100 lead assembly, so that any errors due to the lead assembly are automatically compensated for by the calibrator. This means that the 'lead error' determination method outlined in the previous paragraph, 13.3.7, is not appropriate.

Instead, the verified output values of 1V on the 1V range, and 10V on the 10V range are used to measure the calibrator linearity error at 1V on the 10V range. From the linearity measurement, a 10% of range Linearity and Scaling Factor 'C' is derived. This factor is subsequently used to correct the calibrator output setting at 10% of range, to standardize a DMM for verification of the next range down. Refer to Section 14 to determine the Linearity and Scaling Factor 'C'.

13.3.9 100mV Range HF Verification

a) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 13.4.

b) Set the calibrator to the 1V range. Calculate the value of (V3 x C). Set the OUTPUT display to this value.

Calculate in 6 1/2 digits resolution

V3 x C =

c) Set the DMM to measure 100mV.

d) Set the calibrator output ON, and allow the output to settle. Note the DMM reading as V(100t).

V(100t) is a transfer value

V(100t) =

e) Set the calibrator output OFF and reconnect the DMM to the calibrator terminals using the 4100 lead assembly in 2-wire configuration as shown in Fig 13.5. Ensure that the Guard to Ground switch located on the 4100 terminal connection box located at the calibrator supplying the AC source is closed.

f) Set the calibrator to its 100mV range. (Remote Sense is automatically deselected). Set output ON and adjust the calibrator output for a DMM reading of V(100t). Note the calibrator OUTPUT display value as V(100m).

Record in 6 1/2 digits resolution

V(100m) =

g) V(100m) should be entered in the 'Total Value' column of Report Sheet RS2.

13.3.10 10mV Range HF Verification

a) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 13.5.

b) Set the calibrator to the 100mV range. Calculate the value of (V(100m) x C). Set the OUTPUT display to this value.

Calculate in 6 1/2 digits resolution

V(100m) x C =

c) Set the DMM to measure 10mV.

d) Set the calibrator output ON, and allow the output to settle. Note the DMM reading as V(10t).

e) Set the calibrator to its 10mV range.

f) Set output ON and adjust the calibrator ouput for a DMM reading of V(10t). Note the calibrator OUTPUT display value as V(10m).

V(10t) is a transfer value

V(10t) =

g) V(10m) should be entered in the 'Total Value' column of Report Sheet RS2.

Record in 5 1/2 digits resolution

V(10m) =

13.3.11 1mV Range HF Verification

a) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 13.5.

b) Set the calibrator to the 10mV range. Calculate the value of (V(10m) x C). Set the OUTPUT display to this value.

Calculate in 5 1/2 digits resolution

V(10m) x C =

c) Set the DMM to measure 1mV.

d) Set the calibrator output ON, and allow the output to settle. Note the DMM reading as V(1t).

V(1t) is a transfer value

V(1t) =

e) Set the calibrator to its 1mV range.

f) Set output ON and adjust the calibrator ouput for a DMM reading of V(1t). Note the calibrator OUTPUT display value as V(1m).

Record in 4 1/2 digits resolution

V(1m) =

g) V(1m) should be entered in the 'Total Value' column of Report Sheet RS2.

13.3.12 Linearity Check

This is performed on the 10V range. Check each value shown on the Report Sheet RS2 in the order specified. For each check use the routine detailed in paragraph 13.3.7.

13.3.13 AC Current Checks

1. Carry out the AC voltage performance checks 1 to 4 of paragraph 13.3.6 if the AC voltage performance has not been verified.

2. Verify the performance of the Calibrator AC current function using one of the methods described in the relevant User's Handbook, Section 7.

3. Full Range Checks: To check each value against its specification limits use the following routine:

   (a) Connect the DMM's AC current measurement circuits to the calibrator output terminals as shown in Fig 13.6. Use the type of leads which are normally used for the calibration of the calibrator (eg. short lengths of coaxial cable).

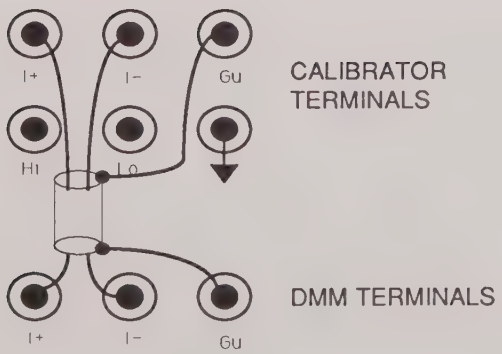


Fig 13.6 AC Current Verification Connections

(b) With calibrator output OFF, select I and the appropriate OUTPUT and FREQUENCY range as detailed in Report Sheet RS2.

(c) DMM: Set to correct function and range.

(d) Calibrator: Use OUTPUT ⇑ and ⇓ keys to set correct current on OUTPUT display, and correct frequency on FREQUENCY display.

(e) Calibrator: Press the ON key.

(f) DMM:Record the DMM reading and note it on Report Sheet RS2. (Calibrator Readings column).

(g) Turn the calibrator output OFF, disconnect the leads from the terminals and replace the 4100 terminal connection box onto the calibrator's terminals. Connect the 4100 lead to the DMM terminals as follows:
I+ lead to DMM I+ terminal. I- lead to DMM I- terminal. Guard lead to DMM Guard terminal.

(h) Calibrator: Press the ON key.

(j) DMM: Record the DMM reading and note it on Report Sheet RS2. (4100 Readings column).

(k) Calibrator: Turn the calibrator output OFF.

(l) Repeat the sequence from 3(a) to 4(k) for all the current settings listed on Report Sheet RS2. Compare the results with the High and Low Specification Limits computed from Formula-V (refer to paragraph 13.4.6).

4100 VERIFICATION REPORT SHEET. RS2

(Use as master for duplicate copies)

Serial Number _____ Date _____

Checked by _____ Company/Dept. _____

1. AC VOLTAGE FULL RANGE CHECKS

Range / Frequency	Output Voltage	Specification Limits		Calibrator Reading	4100 Reading	Lead Error	Calibrator Value	Total Value
		High	Low					
1mV 1kHz	1.0000mV							
1mV 1MHz	1.0000mV							
10mV 1kHz	10.0000mV							
10mV 1MHz	10.0000mV							
100mV 1kHz	100.0000mV							
100mV 1MHz	100.0000mV							
1V 1kHz	1.000000V							
1V 1MHz	1.000000V							
10V 1kHz	10.00000V							
10V 1MHz	10.00000V							
100V 1kHz	100.0000V							
100V 100kHz	100.0000V							
1kV 1kHz	1000.000V							

2. AC VOLTAGE LINEARITY CHECKS

Range / Frequency	Output Voltage	Specification Limits		Calibrator Reading	4100 Reading	Lead Error	Calibrator Value	Total Value
		High	Low					
1mV 1kHz	1.000000V							
1mV 1MHz	10.00000V							
10mV 1kHz	19.00000V							

3. AC CURRENT FULL RANGE CHECKS

Range / Frequency	Output Current	Specification Limits		Calibrator Reading	4100 Reading	Lead Error	Calibrator Value	Total Value
		High	Low					
100µA 300Hz	100.0000µA							
100µA 5kHz	100.0000µA							
1mA 300Kz	1.000000mA							
1mA 5kHz	1.000000mA							
10mA 300Hz	10.00000mA							
10mA 5kHz	10.00000mA							
100mA 300Hz	100.0000mA							
100mA 5kHz	100.0000mA							
1A 300Hz	1.000000A							
1A 5kHz	1.000000A							

13.4 Calculations For Specification Verification.

13.4.1 DCV Full Range Checks: FORMULA-I

(a) Let the DC Calibration Source Voltage be 'W' volts
(b) Let the uncertainty with which W is known be 'X' ppm
(c) Let the OUTPUT display reading for null be 'Y' volts
(d) Let the Calibration Uncertainty of the calibrator be 'Z' ppm
(e) Let the Accuracy Relative to Calibration Standards (ppmR component) for the relevant calibrator be 'A' ppm (obtainable from Section 6 of the applicable User's Manual.)
(f) Let the Accuracy Relative to Calibration Standards (ppmFS component) for the relavant calibrator be 'B' ppm (obtainable from Section 6 of the applicable User's Manual.)

Then the Specification Limits can be determined from the following formulae:

$$\text{Spec Limits} = W \pm \{[(A + Z)\text{ppm of } W] + [B\text{ppm of FS}] + [X\text{ppm of } W]\}$$

EXAMPLE:

The 10V range of a 4000A Calibrator is checked against a buffered bank of ten standard cells with a total DC Calibration Source Voltage of 10.181456V (ie. W = 10.181456V). This value is known to better than ± 2ppm.

The 4000A was calibrated on this range to a value which was known to better than ± 3ppm (ie. Z = 3ppm). A null is achieved against the 4000A when its OUTPUT display is reading 10.181502V (ie. Y = 10.181502V).

The 90 day ± 5°C ppmR specification for the 10V range of the 4000A is 4.5ppm (i.e. A = 4.5ppm), while the corresponding ppmFS specification is 0.5ppm (i.e. B = 0.5ppm, and Bppm of FS = 0.5ppm X 19.999999V = 10μV).

Spec Limits for 10V range = $10.181456 \pm \{[(4.5 + 3)\text{ppm of } 10.181456] + 10\mu V + [2\text{ppm of } 10.181456]\}$
= $10.181456 \pm \{ 76\mu V + 10\mu V + 20\mu V\}$

Therefore High Limit = 10.181562V
and Low Limit = 10.181350V

As the Output Display Voltage lies between these limits, the system spec on this range has been verified.

13.4.2 DC 10V Range Linearity

$$\text{Spec Limits} = W \pm \{[(A + Z)\text{ppm of } Y] + [B\text{ppm of FS}] + [X\text{ppm of } W]\}$$

The method used to calculate the Specification limits is identical to that for the DC full range checks.

13.4.3 DC Current Full Range Checks: FORMULA-II

(a) Let the shunt value be 'U' Ohms
(b) Let the uncertainty in the shunt value be 'V' ppm
(c) Let the DMM reading be 'W' volts
(d) Let the uncertainty in W be 'X' ppm
(e) Let the OUTPUT setting be 'Y' amps
(f) Let the Calibration Uncertainty of the calibrator be 'Z' ppm
(g) Let the Accuracy Relative to Calibration Standards (ppmR component) for the relevant calibrator be 'A' ppm (obtainable from Section 6 of the applicable User's Manual.)
(h) Let the Accuracy Relative to Calibration Standards (ppmFS component) for the relavant calibrator be 'B' ppm (obtainable from Section 6 of the applicable User's Manual.)

Then the Specification Limits can be determined from the following formulae:

Spec Limits = Y ± {[(A + Z)ppm of Y] + [Bppm of FS] + [(Vppm of U)xW] + [(Xppm of W)xU]}

EXAMPLE:

A DMM reading of 100.0005mV, known to ± 10ppm, is taken, when a current of 100.012mA supplied by a 4000A calibrator and passed through a shunt of value 10.00012Ω. The shunt value is known to within ±7ppm and the calibration uncertainty of the 4000A 100mA range is ±10ppm.

The 90 day ± 5°C ppmR specification for the 100mA range of the 4000A is 30ppm (i.e. A = 30ppm), while the corresponding ppmFS specification is 5ppm (i.e. B = 5ppm, and Bppm of FS = 5ppm X 199.9999mA = 1μA).

U= 10.00012Ω
V= 7ppm
W=100.0005mV
X= 10ppm
Y= 100.012mA
Z= 10ppm
A= 30ppm
B=1μA

Spec Limits = 100.012mA ± {[(30 + 10)ppm of 100.012mA] + 1μA + [(7ppm of 10.00012)x100.0005mA] + [(10ppm of 100.0005)x10.00012mA]}

= 100.012mA ± (4μA + 1μA + 7μA + 10μA)

High Limit = 100.034mA
Low Limit = 99.990mA

As the calibration value of 999.993mA, (W ÷ U = 100.0005mV ÷ 10.00012Ω = 999.993mA), lies between these limits, the system meets its specification.

13.4.4 Resistance Value Measurements: FORMULA-III

(a) Let 4100 Lead Resistance be 'W' Ohms
(b) Let the uncertainty in W be 'U'ppm
(b) Let Measured Value be 'X' Ohms
(c) Let the uncertainty in X be 'V' ppm
(d) Let Displayed Value be 'Y' Ohms
(e) Let Calibration Uncertainty of the 4000A be 'Z' ppm
(f) Let the Accuracy Relative to Calibration Standards (ppmR component) for the relevant calibrator be 'A' ppm (obtainable from Section 6 of the applicable User's Manual.)

Then the Specification Limits can be determined from the following formulae:

Remote: Spec Limits = Y ± [(A+ Z)ppm of Y + (V x X)]
Local: Spec Limits = (Y + W) ± {[(140 + Z)ppm of Y] + (V x X) + (U x W) + 0.1Ω}
Local/Zero: Spec Limits = (Y + W) ± [0.1Ω + (V x X) + (U x W)]

EXAMPLE 1 (Remote Sense):

On the 4000A 100Ω range the displayed 4 wire value is 100.00077, 2-wire value is 100.349Ω, and 2-wire zero is 0.306Ω. The 4100 lead resistance is measured as 0.113Ω to an accuracy of ±1mΩ.

The 90 day ±5°C accuracy relative to Calibration Standards of the 4000A 100Ω range is 7ppm, and the calibration uncertainty of the 4000A on this range is ±5ppm.

The following reading was taken by a standardized DMM:
Remote: 100.00056 ± 10ppm

A= 7ppm
V= 10ppm
X= 100.00056Ω
Y= 100.00077Ω
Z= 5ppm

Spec Limits = Y ± [(A + Z)ppm of Y + (V x X)]
= 100.00077Ω ± (12ppm of 100.00077Ω + 10ppm of 100.00056Ω)
= 100.00077Ω ± (1.2mΩ + 1mΩ)

High Limit = 100.00297Ω
Low Limit = 99.99857Ω

As the reading of 100.00056 lies well within these limits, the system meets its specification.

EXAMPLE 2 (Local Sense):

The following reading was taken by a standardized DMM:
Local: 100.459 ± 20ppm

A= 7ppm
V= 20ppm
W= 0.113Ω
U x W= 1mΩ
X= 100.459Ω
Y= 100.349Ω
Z= 5ppm

Spec Limits = (Y + W) ±{[(A + Z)ppm of Y] + (V x X) + (U x W) + 0.1Ω}
= (100.462Ω) ± [(12ppm of 100.349Ω) + (20ppm of 100.459Ω) + 1mΩ + 0.1Ω]
= 100.462Ω ± (1.2mΩ + 2mΩ + 1mΩ + 0.1Ω)

High Limit = 100.565Ω
Low Limit = 100.359Ω

As the measured value is 100.459Ω, it can be seen that the system is within its specification.

EXAMPLE 3 (Local / Zero):

The following reading was taken by a standardized DMM:
Local /Zero: 0.417Ω ± 1mΩ

V x X= 1mΩ
U x W= 1mΩ
W= 0.113Ω
X= 0.417Ω
Y= 0.306Ω

Spec Limits = (Y + W) ± [0.1Ω + (V x X) + (U x W)]
= 0.419Ω ± (0.1Ω + 0.001Ω + 0.001Ω)

High Limit = 0.521Ω
Low Limit = 0.317Ω

The measured value of 0.417Ω lies between the limits, and therefore the system meets specification.

13.4.5 AC Full Range Checks: Formual IV

Notes on Terminology of Report Sheet RS2:

(1) The column headed 'Lead Error' is derived by subtracting the '4100 Readings' from their corresponding 'Calibrator Readings'.

(2) 'Calibrator Value' refers to the readings taken on the calibrator in isolation from the system, as described in the relevant User's Handbook Section 7.

(3) 'Total Value' is the sum of 'Calibrator Value' and the 'Lead Error'.

(a) Let the Lead Error be 'L' volts
(b) Let the Calibrator Value be 'W' volts
(c) Let the uncertainty in W be 'Z' ppm
(c) Let the Calibration Uncertainty of the calibrator be 'X' ppm
(d) Let the Output setting of the calibrator be 'Y' volts
(e) Let the Accuracy Relative to Calibration Standards (ppmR component) for the relevant calibrator be 'A' ppm (obtainable from Section 6 of the applicable User's Manual.)
(f) Let the Accuracy Relative to Calibration Standards (ppmFS component) for the relavant calibrator be 'B' ppm (obtainable from Section 6 of the applicable User's Manual.)

Then the Specification Limits can be determined from the following formula:

$$\text{Spec Limits} = Y \pm \{[(A + X)\text{ppm of } Y] + (B\text{ppm of FS}) + (Z \times W)\}$$

Note that these limits are to be compared against 'Total Value', ie. calibrator Value plus Lead Error (W + L).

EXAMPLE:

A 4200A is verified on the 1V range at 1kHz. A null is obtained with a Themal Transfer standard against a DC voltage source at 1.000023V, with a total transfer uncertainty of ± 60ppm.
A pair of readings is taken to determine the 4100 lead error at this point as 25μV.
The uncertainty with which the 4200 was originally calibrated is ± 50ppm.

A= 70ppm
B= 10ppm
L = 25μV
W = 1.000023V
Z = 60ppm
X = 50ppm
Y = 1.000000V

Spec Limits = Y ± {[(A + X)ppm of Y] + (Bppm of FS) + (Z x W)}
= 1 ± {[(70 + 50)ppm of 1.000000] + [10ppm of 1.9999999V] + [60ppm of 1.000023V]
= 1 ± (120μV + 20μV + 60μV)
= 1 ± 200μV

High Limit = 1.000200V
Low Limit = 0.999800V

The 'Total Value' is W + L, which equals 1.000048V. This lies between the limits and therefore the system meets specification.

13.4.6 ACI Full Range Checks: FORMULA-V

(a) Let the Lead Error be 'L' amps
(b) Let the Calibrator Value be 'W' amps
(c) Let the uncertainty in W and its thermal transfer be 'Z' ppm
(c) Let the Calibration Uncertainty of the calibrator be 'X' ppm
(d) Let the Output setting of the calibrator be 'Y' amps
(e) Let the Accuracy Relative to Calibration Standards (ppmR component) for the relevant calibrator be 'A' ppm (obtainable from Section 6 of the applicable User's Manual.)
(f) Let the Accuracy Relative to Calibration Standards (ppmFS component) for the relavant calibrator be 'B' ppm (obtainable from Section 6 of the applicable User's Manual.)

Then the Specification Limits can be determined from the following formula:

Spec Limits = Y ± {[(A+ X)ppm of Y] + (Bppm of FS) + (Z x W)}

Note that these limits are to be compared against 'Total Value', ie. Calibrator Value plus Lead Error (W+L).

EXAMPLE:

When measured in isolation from the 4100 system the 100mA 300 Hz output was measured as 100.0021mA ± 120ppm using a Thermal Transfer standard fitted with a current shunt. The additional lead error due to the 4100 system lead kit was measured as being 13µA at this point.

A= 220ppm
B= 50ppm
L = 13µA
Z = 120ppm
W = 100.0021mA
X = 100ppm
Y = 100.0000mA

Spec Limits = Y ± {[(A+ X)ppm of Y] + (Bppm of FS) + (Z x W)}
= 100mA ± {[(220 + 100)ppm of 100.0000mA] + (50ppm of 199.9999mA)+ (120ppm of 100.0021mA)}
= 100mA ± (32µA + 10µA + 12µA)
= 100mA ± 54µA

High Limit = 100.0540mA
Low Limit = 99.9460mA

The 'Total Value' is W + L, which equals 100.0151mA. This lies between the limits and therefore the system meets specification.

SECTION 14: 4100 CALIBRATION

14.1 Introduction

The calibration of the 4100 system is achieved by first calibrating the individual calibrators according to the methods described in Section 1 of the applicable Calibration and Servicing Handbook for the calibrators..
The performance of the entire 4100 system, including the lead assembly, is then verified using the methods described in Section 13 of this handbook.

There are two areas where the approach outlined above is not followed:
(i) mV ranges HF Calibration.
(ii) 2-Wire HF Compensation.

In both cases, the effect of the 4100 lead assembly is significant and must be taken into account by calibrating the calibrator directly through the 4100 lead assembly.

Note that as the 4705 calibrator does not possess the capability of sourcing a 1MHz signal, this entire section does not apply.

14.2 Millivolts (HF) Calibration

The verified output values of the 1V on the 1V range, and 10V on the 10V range are used to measure the calibrator linearity error at 1V on the 10V range. From the linearity measurement, a 10% of range Linearity and Scaling factor 'C' is derived.

This factor is subsequently used to correct the calibrator output setting at 10% of range, to standardise a DMM for calibration of the next range down.

Note that these calibrations are not fully traceable, and it is assumed that Millivolt (LF) Calibration has been completed.

14.2.1 Equipment Requirements

A DMM capable of stable AC measurements to (preferably) 100nV resolution.
Example: Datron 1081

14.2.2 Linearity and Scaling Factor 'C'

'C' is a number of value close to 0.1, and is derived as follows:

a) Ensure that the calibrator has been calibrated and verified at 10V and 1V (1MHz) Full Range, according to the methods outlined in Secton 1 of the applicable Calibration and Servicing Handbook.

Record the measured values as follows:

Calibrator 10V FR setting: 10.000,00V
Actual output voltage: V1

Calibrator 1V FR setting: 1.000,000V
Actual output voltage: V2

b) Calculate 1V correction: V3 = 1÷V2

c) With output OFF, connect a DMM to the calibrator terminals using the 4-wire connections as shown in Fig 14.1. Set the DMM to measure AC on its 1V range.

d) On the calibrator select the 1V range and Remote Sense. Set frequency to 1MHz. Set OUTPUT display to V3. Turn output ON, and note the DMM reading as Vt. Turn output OFF.

e) On the calibrator select the 10V range (Remote Sense). Set the 4200 OUTPUT display to 1V and turn output ON. Adjust the OUTPUT display for a DMM reading of Vt.

f) Note the calibrator OUTPUT display reading as V4, and turn the output OFF.

g) From the values V1 and V4, calculate the 10V range linearity correction and scaling factor 'C' as follows:

C = (V1 x V4)÷100

Note:
The optimum resolutions quoted above the boxes in this column may not be achievable with the DMM in use. In these cases it is permissible to reduce resolution by a maximum of 1 digit only.

Record in 6 1/2 digits resolution

V1 =
V2 =
V3 =

Vt is a transfer value

Vt =

Record in 6 1/2 digits resolution

V4 =

Calculate in 6 1/2 digits resolution

C =

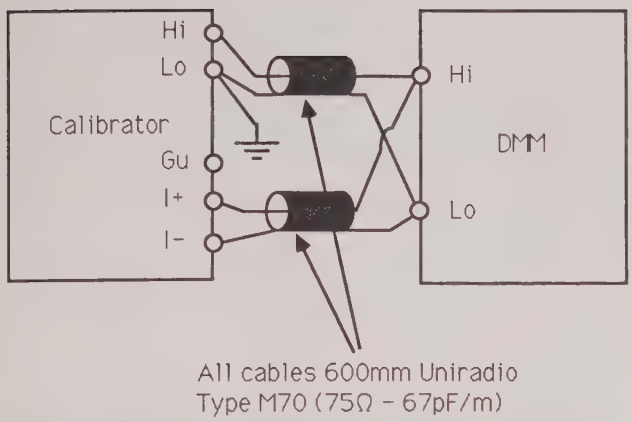


Fig 14.1 Interconnections (10V and 1V Ranges)

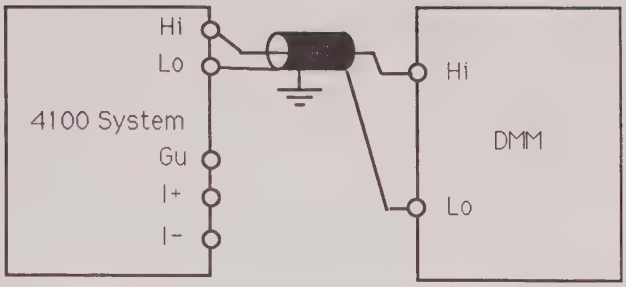


Fig 14.2 Interconnections (100mV and 1V Ranges)

14.2.3 100mV Range Full Range Calibration

a) Insert the calibration security key into the 'CALIBRATION ENABLE' switch on the calibrator rear panel, and turn to 'ENABLE'.

b) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 14.1.

c) Set the calibrator to the 1V range. Calculate the value of (V3 x C). Set the OUTPUT display to this value.

d) Set the DMM to measure 100mV.

e) Set the calibrator output ON, and allow the output to settle. Note the DMM reading as V(100t).

f) Set the calibrator output OFF and reconnect the DMM to the calibrator terminals using the 4100 lead assembly in 2-wire configuration as shown in Fig 14.2. Ensure that the Guard to Ground switch located on the 4100 terminal connection box is closed.

g) Set the calibrator to its 100mV range. (Remote Sense is automatically deselected). Set output ON and adjust the 4200 ouput for a DMM reading of V(100t). Press the 'CAL' pushbutton and observe the DMM reading.

h) Repeat operation (g) until the post-cal DMM reading is within 1μV of V(100t).

Note that this operation may only be performed with the calibrartion keyswitch on the rear panel of the calibrator turned to 'cal' and the IEEE-488 address switch set to 31 (11111).

Calculate in 6 1/2 digit resolution

V3 x C =

V(100t) is a transfer value

V(100t) =

14.2.4 10mV Range Full Range Calibration

a) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 14.2.

b) Set the calibrator to the 100mV range. Calculate the value of (100mV x C). Set the OUTPUT display to this value.

c) Set the DMM to measure 10mV.

d) Set the calibrator ouput ON, and allow the output to settle. Note the DMM reading as V(10t).

e) Set the calibrator to its 10mV range.

f) Set output ON and adjust the calibrator ouput for a DMM reading of V(10t). Press the 'CAL' pushbutton and observe the DMM reading.

g) Repeat operation (f) until the post-cal DMM reading is within 1µV of V(10t).

Calculate in 6 1/2 digit resolution

100mV x C =

V10(t) is a transfer value

V(10t) =

14.2.5 1mV Range Full Range Calibration

a) Ensure that the DMM is connected to the calibrator terminals as shown in Fig 14.2.

b) Set the calibrator to the 10mV range. Calculate the value of (10mV x C). Set the OUTPUT display to this value.

c) Set the DMM to measure 1mV.

d) Set the calibrator ouput ON, and allow the output to settle. Note the DMM reading as V(1t).

e) Set the calibrator to its 1mV range.

f) Set output ON and adjust the calibrator ouput for a DMM reading of V(1t). Press the 'CAL' pushbutton and observe the DMM reading.

g) Repeat operation (f) until the post-cal DMM reading is within 1µV of V(1t).

Calculate in 5 1/2 digit resolution

10mV x C =

V(1t) is a transfer value

V(1t) =

14.2.6 Calibration Disable

Turn the Calibration security key, inserted in the 'CALIBRATION ENABLE' switch on the rear panel, to 'RUN'. Remove the key.

14.3 HF 2-Wire Compensation

On the calibrator 1V and 10V ranges there are two HF calibration memories. One holds the correction value obtained during Remote Sense (4-wire) calibration; the other contains a 2-wire HF compensation value which is added to the first correction when Remote Sense is not selected (Local Sense).

It is important that the 2-wire HF compensation correction is calibrated using the lead assembly of the 4100 system, as the lead has a significant effect in this area.

During a 4-wire HF calibration on the 1V or 10V range, the stored HF 2-wire compensation value is cleared to zero. Any 4-wire HF calibration to be performed must therefore be completed before the 2-wire compensation is executed.

14.3.1 Calibration Points

The calibrator should be calibrated at, or close to, the calibration points listed below, selecting SET as required.

(i) 1V Range: Nominal ouput voltage = 1.000000V at 1MHz

(ii) 10V Range: Nominal ouput voltage = 10.00000V at 1MHz

14.3.2 Equipment Requirements

A DMM capable of stable AC voltage measurements. Example: Datron 1081

14.3.3 Calibration Sequence

a) Turn the calibration security key in the rear panel switch to the 'ENABLE' position.

b) With the calibrator output OFF, make 4-wire connections between the 4100 system and the DMM, as in Fig 14.1

c) Configure the DMM for AC measurement at the required calibration voltage.

d) Select AC and the required output range on the calibrator. Set the 1MHz frequency range and use the FREQUENCY ⇑ and ⇓ keys to display the required frequency. Use the OUTPUT ⇑ and ⇓ keys to display the required calibration voltage.

e) Set the calibrator output ON (and if not at nominal full range, select SET), and record the DMM reading. Turn the calibrator output OFF.

f) Deselect Remote Sense on the calibrator.

g) Connect the DMM to the 4100 system as in Fig 14.2 and set calibrator output ON.

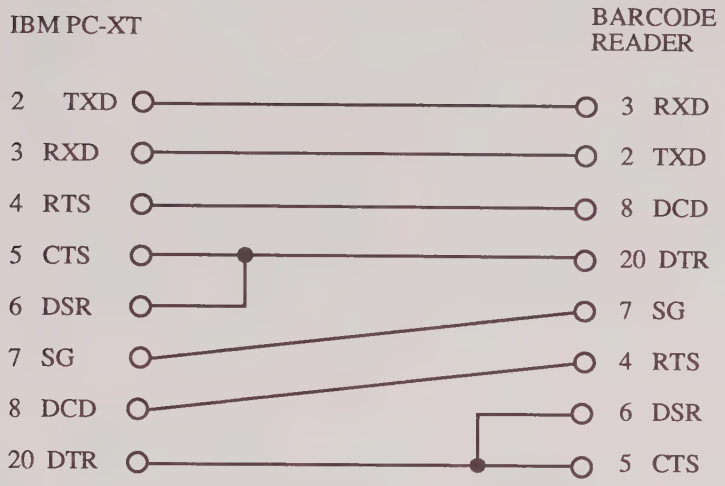
h) Use the calibrator OUTPUT ⇑ and ⇓ keys to display the DMM reading recorded in (e).

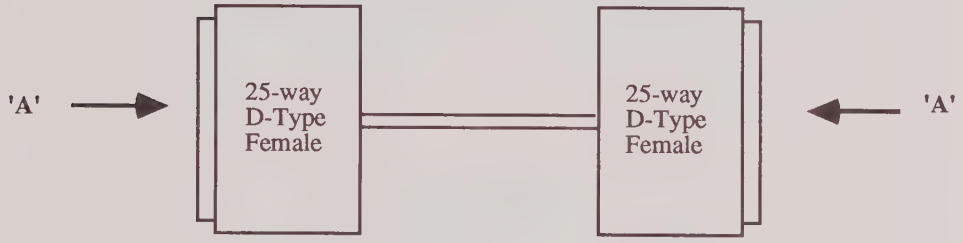
j) Press the CAL pushbutton.

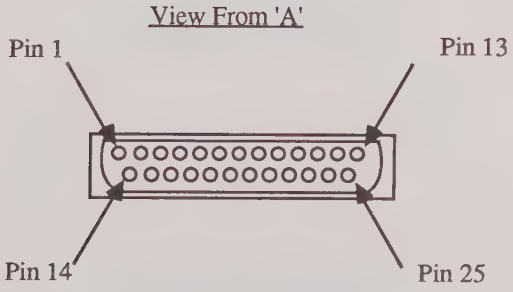
14.3.4 Calibration Disable

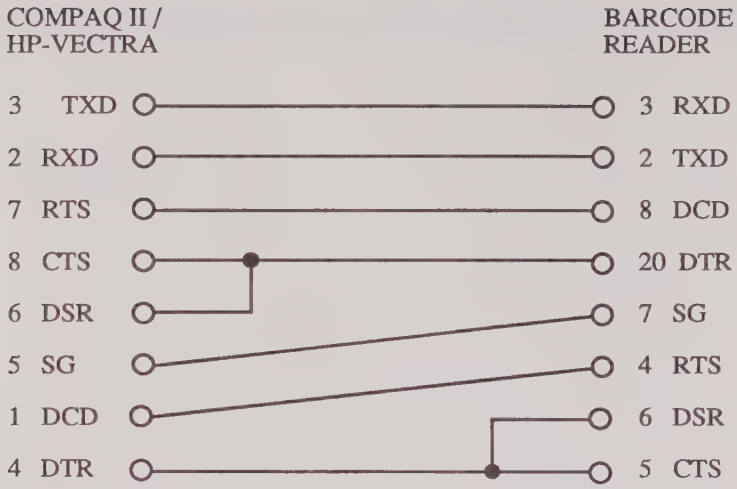
Turn the Calibration security key, inserted in the 'CALIBRATION ENABLE' switch on the rear panel, to 'RUN'. Remove the key.

APPENDIX I: RS-232C CABLE CONFIGURATIONS





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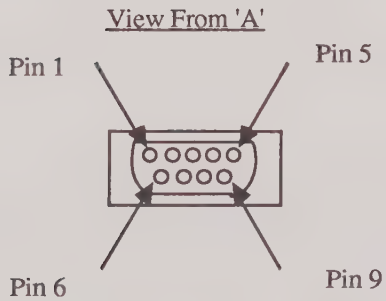
HP-VECTRA
BARCODE
READER
3 TXD
2 RXD
7 RTS
8 CTS
6 DSR
5 SG
1 DCD
4 DTR
3 RXD
2 TXD
8 DCD
20 DTR
7 SG
4 RTS
6 DSR
5 CTS

'A'
9-way
D-Type
Female
25-way
D-Type
Female
'B'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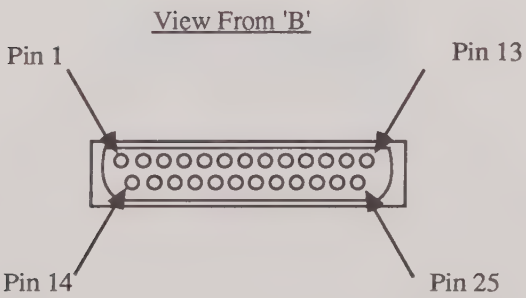
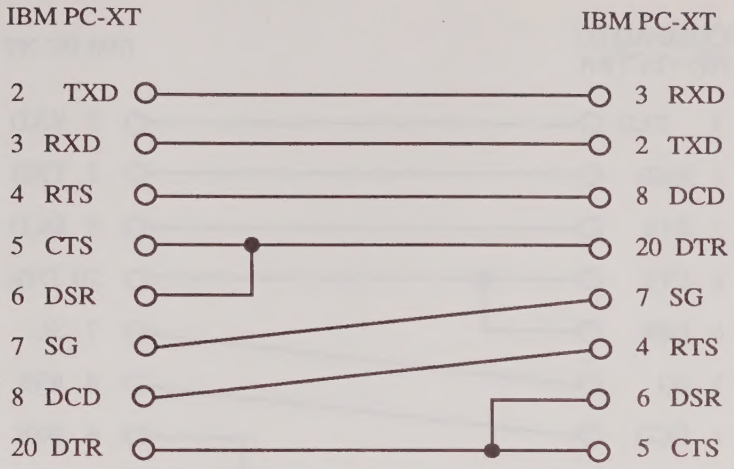
Pin 5
Pin 6
Pin 9


View From 'B'
Pin 1
Pin 13
Pin 14
Pin 25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IBM PC-XT
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5 CTS
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20 DTR
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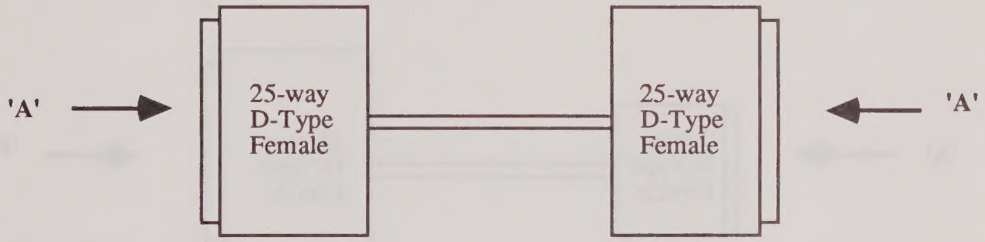
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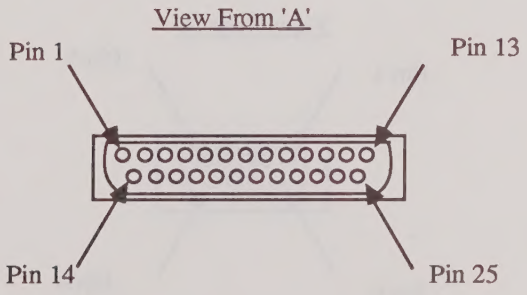
25-way
D-Type
Female
25-way
D-Type
Female
'A'


View From 'A'
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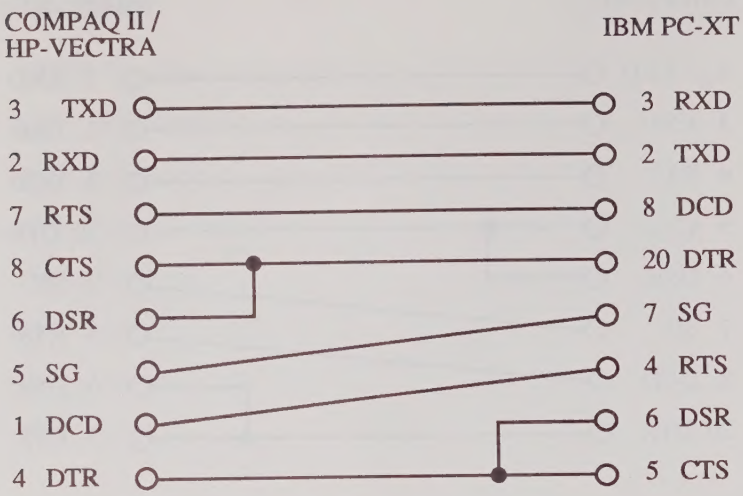
Pin 13
Pin 14
Pin 25


COMPAQ II /
HP-VECTRA
IBM PC-XT
3 TXD
2 RXD
7 RTS
8 CTS
6 DSR
5 SG
1 DCD
4 DTR
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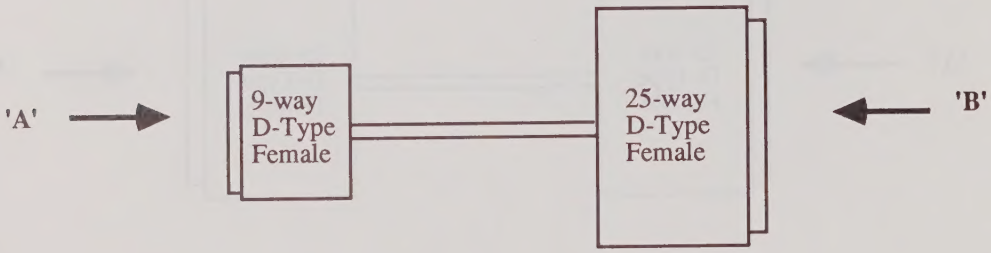
7 SG
4 RTS
6 DSR
5 CTS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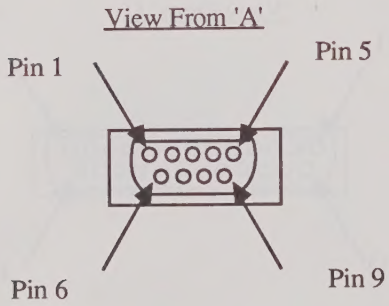
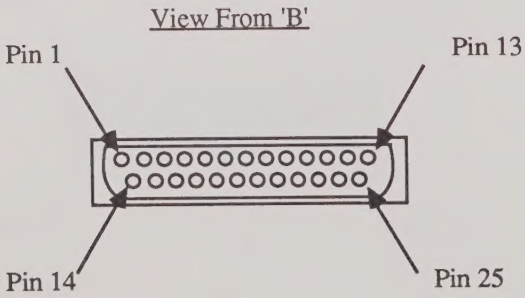
9-way
D-Type
Female
25-way
D-Type
Female
'B'


View From 'A'
Pin 1
Pin 5
Pin 6
Pin 9


View From 'B'
Pin 1
Pin 13
Pin 14
Pin 25